NOVEMBER 1, 1954

Price 35 Cents

Electrical World

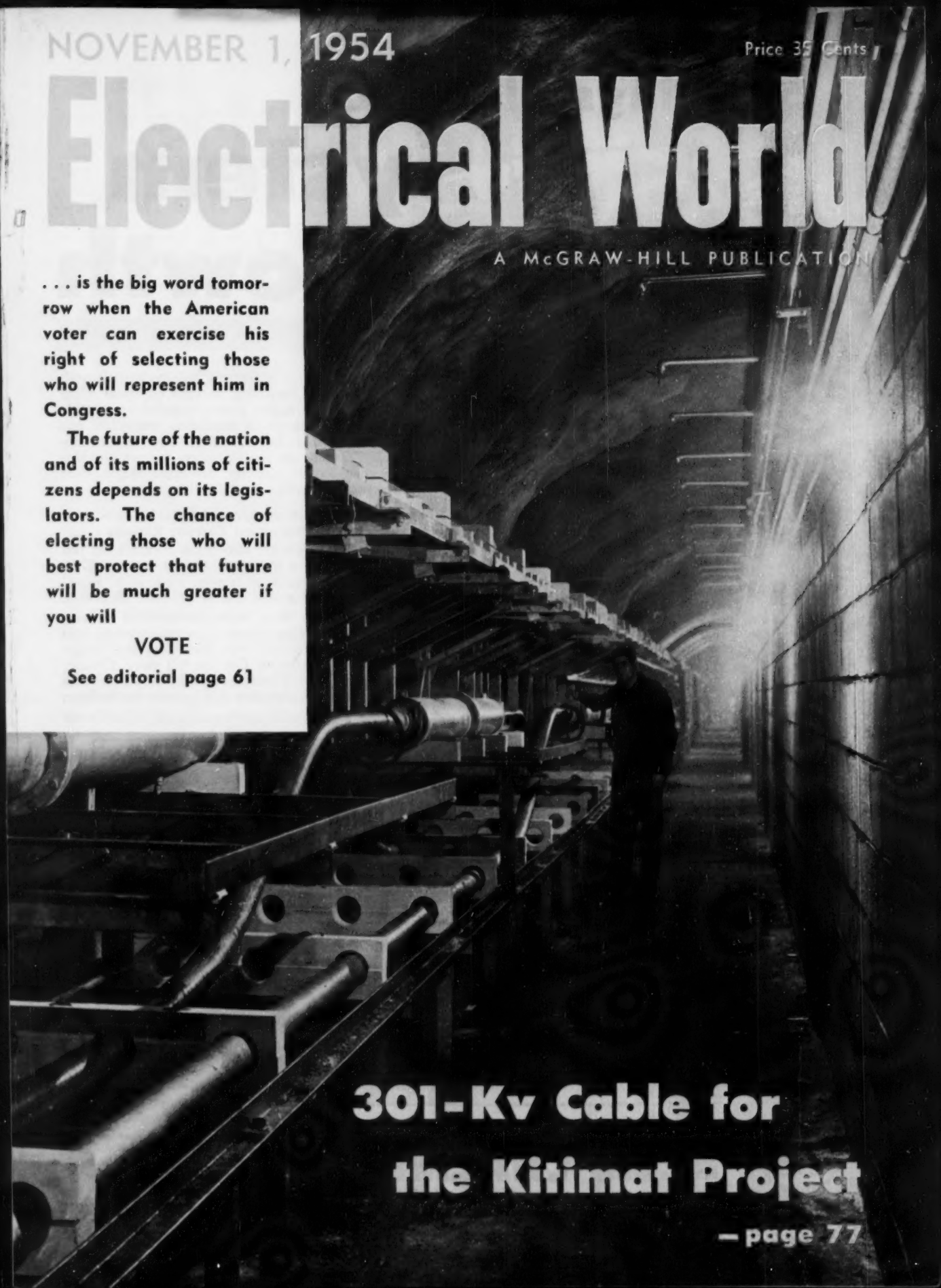
A McGRAW-HILL PUBLICATION

. . . is the big word tomorrow when the American voter can exercise his right of selecting those who will represent him in Congress.

The future of the nation and of its millions of citizens depends on its legislators. The chance of electing those who will best protect that future will be much greater if you will

VOTE

See editorial page 61



301-Kv Cable for the Kitimat Project

— page 77

5 Ratings allow for System Growth

THERE IS PLENTY OF ROOM for system growth because the *Vari-Amp* feature on these Allis-Chalmers single-phase power regulators permits operation at 5 ranges of regulation instead of one half-range setting. Initial cost is lower in most instances. In addition, the *Vari-Amp* feature provides extra short-circuit capacity. No other single-phase power regulator offers flexibility like this.

Unequal Range Gives Full 10% Buck Even at Increased Current Ratings

The *Vari-Amp* feature also permits retaining full 10% buck even at increased current ratings. Then the regulator operates at heavier loads in a "raise" direction . . . at lighter loads in a "lower" direction.

In addition to those important multiple ratings, you get low exciting current, low maintenance, and close, accurate control with Allis-Chalmers single-phase power regulators. Get the full story. Contact your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 01B6065C.

A-4461

Vari-Amp feature makes possible these additional ratings

2400	12	50 amp	57 amp	66.5 amp	80 amp	100 amp
	24	100	114	133	160	200
	36	150	171	200	240	300
	48	200	229	267	320	400
	60	250	286	334	400	
	72	300	343	400		
	96	400				
4800	12	25	28.6	33.3	40	50
	24	50	57	66.5	80	100
	36	75	85.7	100	120	150
	48	100	114	133	160	200
	60	125	143	167	200	250
	72	150	171	200	240	300
	96	200	229	267	320	400
	120	250	286	334	400	
	167	348	397			
6900	17.3	25	28.6	33.3	40	50
	34.5	50	57	66.5	80	100
	69	100	114	133	160	200

Extra Short-Circuit Capacity Available

25 times normal short-circuit capacity available with each of these current ratings gives short-circuit capacities as high as 10,000 amperes on smaller units.

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Electrical World

Vol. 142 No. 18 November 1, 1954

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ELECTRICAL WORLD

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This plot has a story for paper cable users

The curves plotted above tell the story of high internal pressure tests made on three lengths of paper cable indentical in construction except for the sheath design.

Cable Sheath #1: Copper-silver-bearing lead of AEIC recommended thickness

Cable Sheath #2: Okometal alloy of AEIC recommended thickness

Cable Sheath #3: Composite design with Okometal alloy of two-thirds AEIC thickness plus Okosheath Protective Covering

Sheath #1, having the least resistance to internal pressure, started to "neck down" or thin-out at one spot, which led to a rapidly increasing expansion and failure after only 1152 hours on test. Sheath #2, made with unprotected Okometal of full AEIC thickness, was still on test after 6000 hours, indicating its superiority over a conventional lead sheath. Composite sheath #3, made with Okometal of reduced thickness but having an Okosheath Protective Covering, was not only still on test after 6000 hours, but also showed a flat curve that indicated the highest degree of stability with no tendency to "neck down."

Along with the advantages disclosed above, the composite sheath construction of Okometal plus Okosheath Protective Covering possesses superior resistance to scoring during installation and eliminates both chemical and electrolytic corrosion. These features are fully discussed in Bulletin EW-1047, available upon request from The Okonite-Callender Cable Company, Passaic, New Jersey.

1721

OKONITE OKONITE SINCE 1878 ***insulated cables***

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

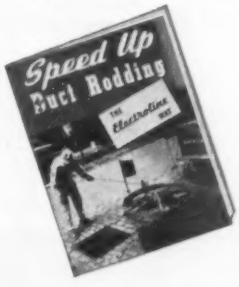
EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

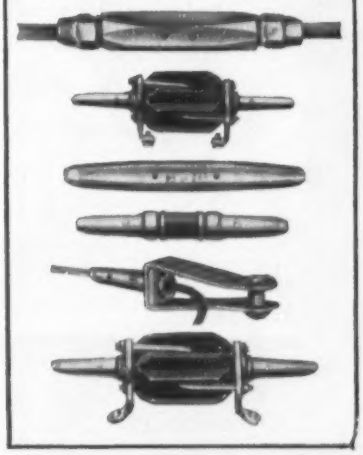
- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.



OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

ARE YOU SECTIONALIZING YOUR FEEDERS AT

Now the simpler operating methods possible with S&C Load Interrupters can save equipment costs at sectionalizing points by almost one half.

S&C Load Interrupters can switch the circuit *without any external arcing.*

This means you can now use stick operation at many points where the present practice is group operation . . . group operation perhaps for the single purpose of actuating disconnects or horn-gaps when mounted upright at pole-top locations to give the necessary clearances for their rising arcs.

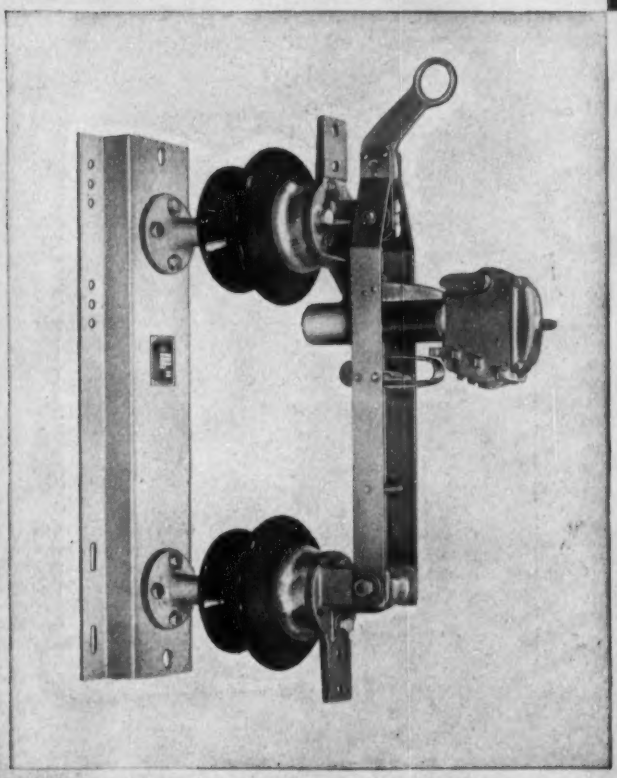
With the stick-operated* Load Interrupter, you actually save three ways: (1) No costly operating mechanism and pole-top frame to purchase; (2) Installation labor radically lowered; (3) Maintenance and adjustment costs reduced to a minimum.

Of course this cost-saving is just part of the story. Since the Load Interrupter can switch the circuit under any condition except short circuit, it permits completely new practices in switching distribution feeders.

**However, S&C Load Interrupters may also be obtained for group operation.*

Would you like to read more about the S&C Load Interrupter and how it saves money while improving operating practices? Write today for Catalog Section 760.

DISTRIBUTION LOWEST COST?



Inverted Interrupters are readily accessible for operation with a hook stick.

Single-pole Load Interrupters for vertical mounting—14.4 kv 600 amp.

S&C ELECTRIC COMPANY

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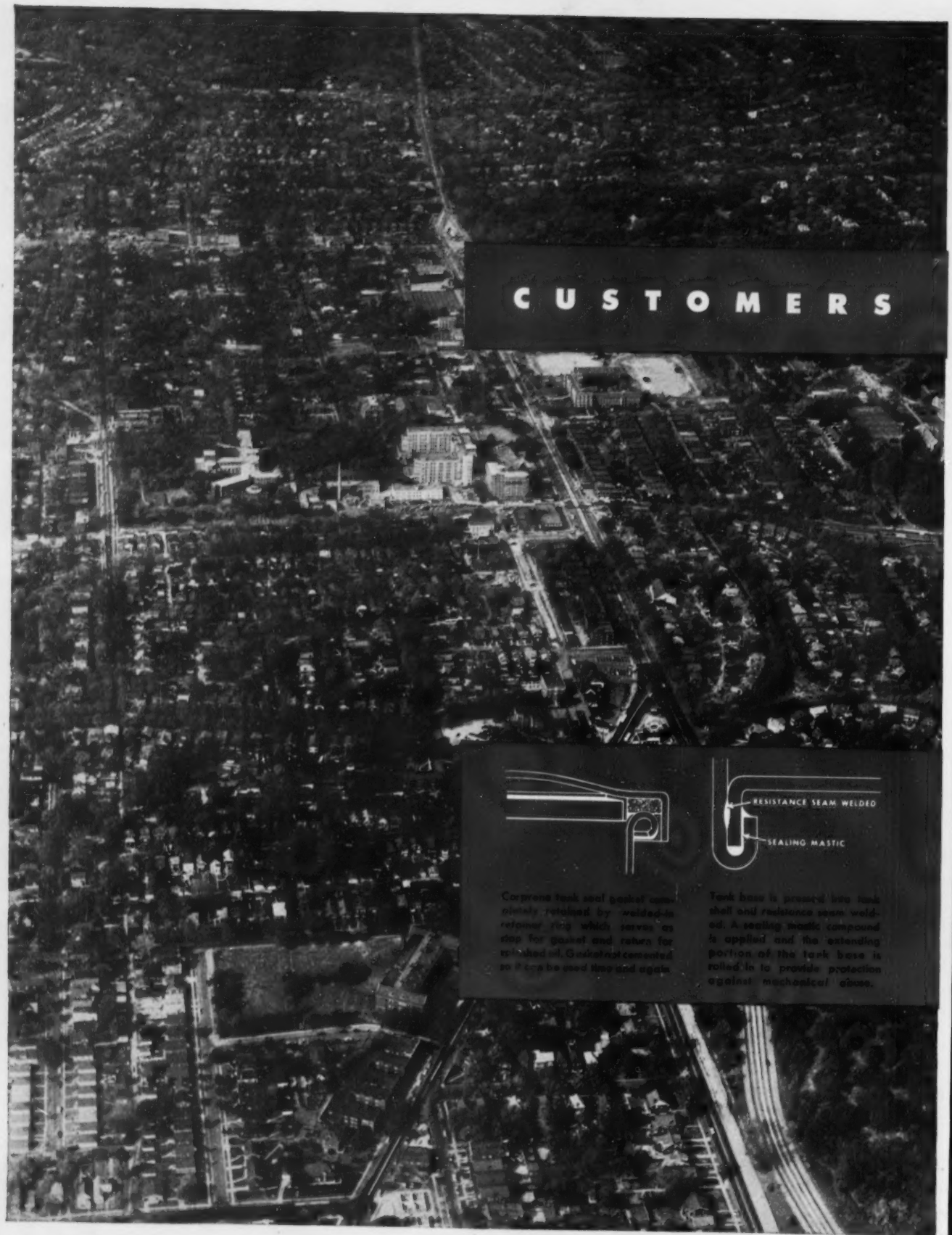
POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Specialists in High-Voltage Circuit Interruption

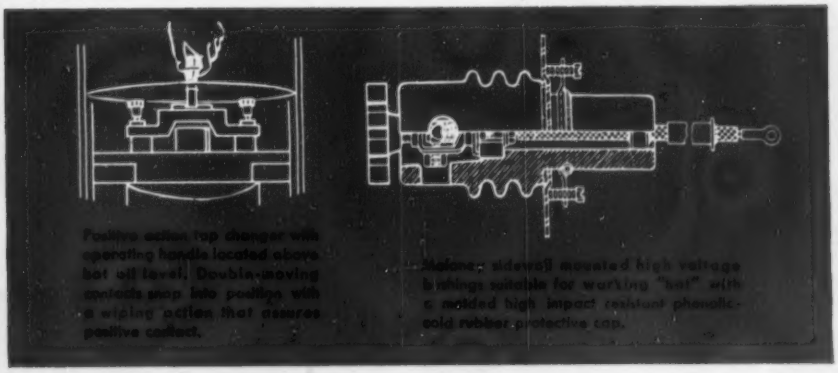

CUSTOMERS
RESISTANCE SEAM WELDED
SEALING MASTIC

BY THE ACRE

The housing developments springing up in every community have brought customers by the acre. Operating headaches by the acre have in turn been brought to distribution engineers. Feeders have to be extended . . . new substations put into service . . . secondary systems hung and put into operation quickly. For these new customers want, and expect, dependable service.

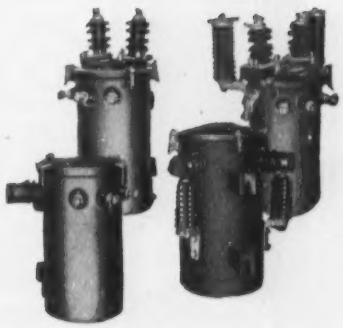
Design greater dependability into your distribution systems . . . eliminate voltage problems . . . build better customer relations by installing Moloney Distribution Transformers. To give your customers the service they deserve and assure your system of better service with less maintenance . . . make it Moloney all along the line.

MED4-18



Positive action tap changer with operating handle located above oil level. Double-moving contacts snap into position with a wiping action that assures positive contact.

Moloney sidewall mounted high voltage bushings suitable for working "hot" with a molded high impact resistant phenolic-oxid rubber protective cap.



Moloney HiperCore Distribution Transformers are available in all standard ratings from 3 Kva up in both Conventional and CSP designs.

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers • Load Center Transformers • Unit Substations Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Sorry, the line is busy

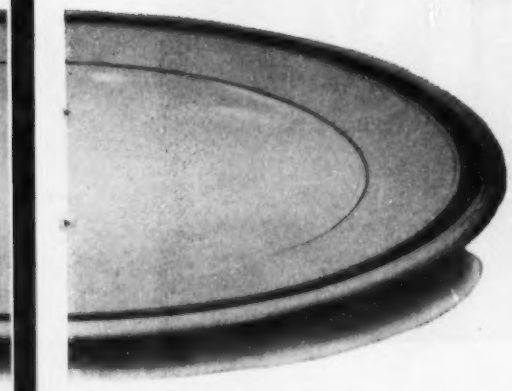
It's enough to drive a man crazy. The toaster ticks away in waltz time
. . . when the bread pops out, it's still white. Coffee not ready yet? That automatic coffee maker sure is taking its time. Watch out, you'll miss the 8:02 again!

While we're at it — how about the other appliances in your home
. . . dryer, washer, deep-freeze, ironer, broiler, mixer, vacuum?
Are they working the way they should?
Or do they seem to lack pep and ambition?

Every electrical appliance man has designed was dreamed up as a convenience for his fellow man. Progress gets punched in the nose when appliances don't do what they're supposed to do. Flick on a few of them at once, and they're hungrier for more juice than your present circuits can deliver. The reason they flub—*inadequate wiring.*

Today, there are at least 60 appliances designed to make home living better, easier and less costly. Ten years ago close to half that number. So you see — the appliance makers have moved ahead so fast the wiring in your home can't keep up with them. Needed badly — larger cable, more circuits, extra switches and outlets, modernized panelboards. Not just for today either . . . but generously adequate for tomorrow's electrical wonders.

Experts estimate at least 90% of the homes in this country, old and new, suffer from *inadequate wiring.* Make sure yours is not one. See your local light and power company. Their counsel will help you. Or write us for your free copy of *"Getting the Most from Your Home's Electrical System."*



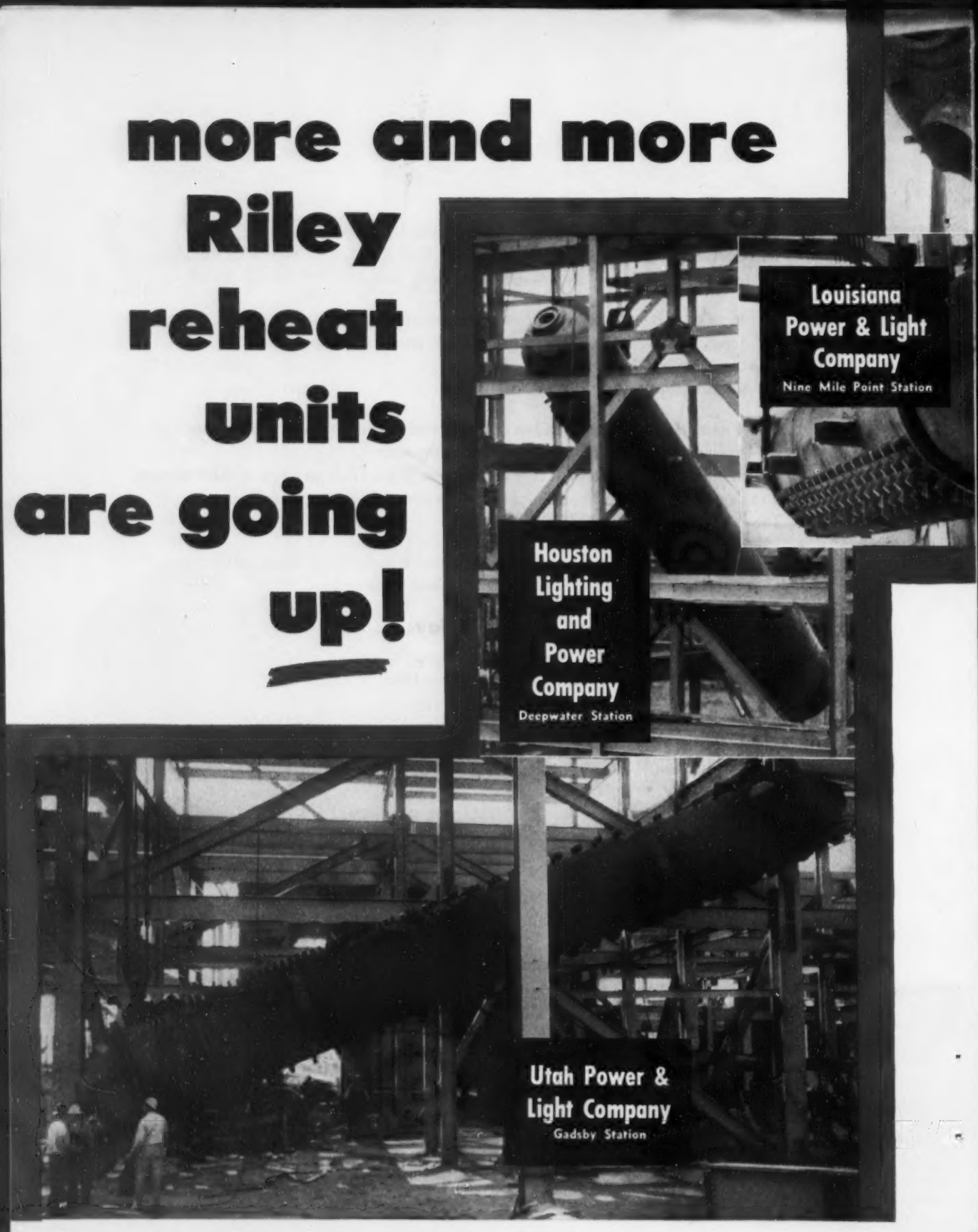
This message is the fifth in a series currently appearing in magazines reaching more than a million readers — business men and home-owners. It is sponsored by Electrical World for the most unselfish-selfish reason—what is good for the electric power industry is good for the publication that has served it continuously for 80 years.

Electrical World

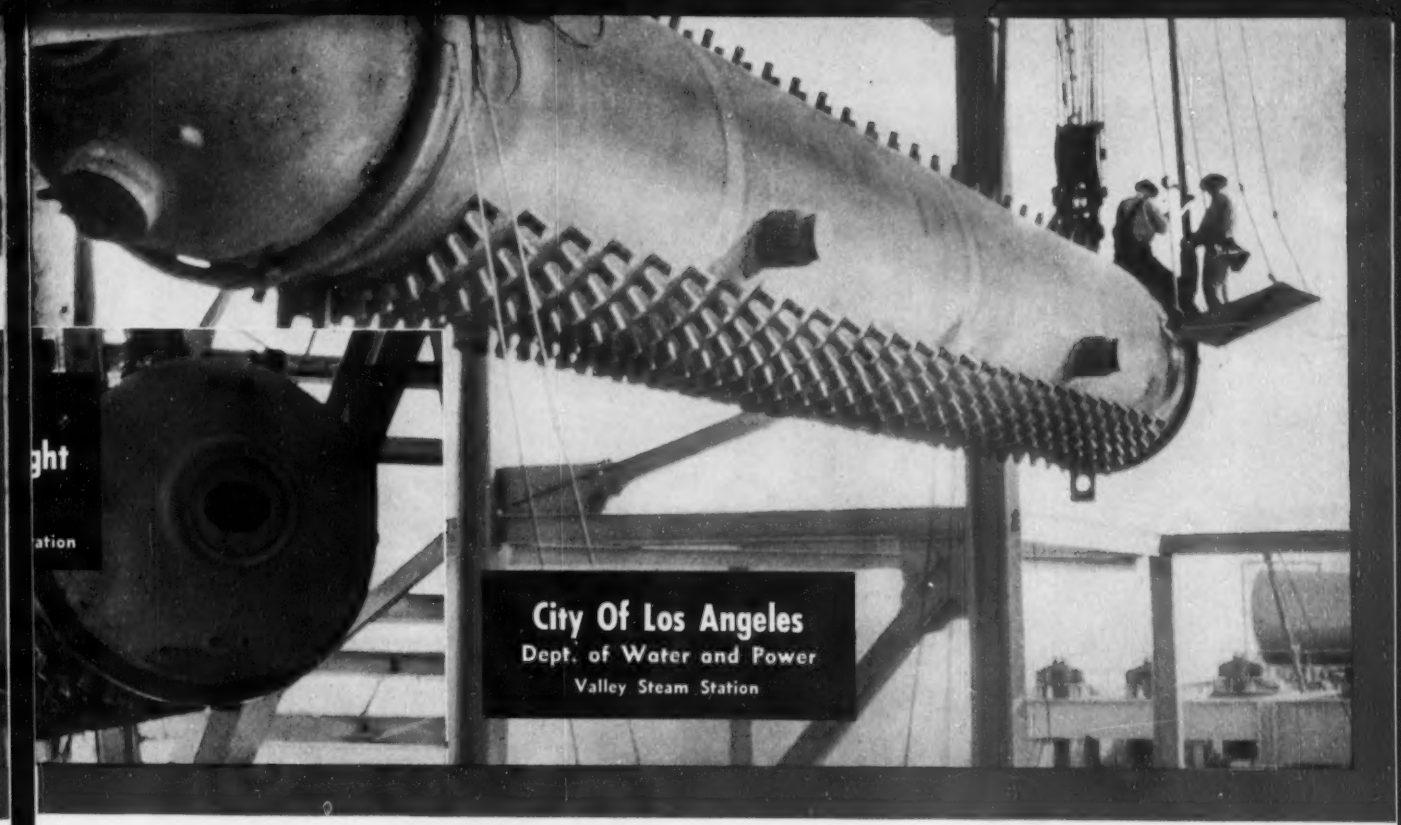
ADEQUATE WIRING SERVES AND SAVES

A McGRAW-HILL PUBLICATION, 330 WEST 42ND STREET, NEW YORK 36, NEW YORK • ABC — ABP

more and more Riley reheat units are going up!



A survey of your plant by a consulting engineer will possibly show



These Important Public Utilities Have Selected Riley Reheat Units

Florida Power Corporation
Suwannee River Plant
Ellaville, Florida
1-600,000 lbs./hr; 1700 psig;
1000/1000F;
Fuel: Gas and Oil; Future
Pulverized Coal

City of Los Angeles
Dept. of Water & Power, Valley Steam
Plant, Sun Valley, Calif.
2-1,200,000 lbs/hr; 2075 psig;
1000/1000F;
Fuel: Gas and Oil

Houston Lighting & Power Company
Sam Berton Steam Electric Station;
Deepwater Station, Houston, Texas
Two 1,200,000 lbs/hr units; 2125 psig;
1005/1005F;
Fuel: Gas and Oil
Ebasco Services, Inc., Cons. Engrs.

Texas Electric Service Co.
Eagle Mountain Steam Electric Station
Fort Worth, Texas
1-1,250,000 lbs/hr; 2125 psig;
1005/1005F;
Fuel: Gas and Oil
Ebasco Services, Inc., Cons. Engrs.

Louisiana Power & Light Company
Nine Mile Point Station, New Orleans
1-1,000,000 lbs/hr; 1725 psig;
1005/1005F; Fuel: Natural Gas
Ebasco Services, Inc., Cons. Engrs.

Public Service Co. of Indiana
Wabash River Station, W. Terre
Haute, Ind.
1-805,000 lbs/hr; 2075 psig;
1005/1005F;
Fuel: Pulverized Coal;
Sargent & Lundy, Cons. Engrs.

Central Louisiana Electric Co., Inc.
Teche Power Station
Baldwin, Louisiana
1-350,000 lbs/hr; 1050 psig;
1005/1005F;
Fuel: Gas and Oil
Sargent & Lundy, Cons. Engrs.

Utah Power & Light Company
Gadsby Station, Salt Lake City, Utah
1-575,000 lbs/hr; 1700 psig;
1000/1000F;
Fuel: Pulverized Coal, Pitch and Oil
Bechtel Corp., Consulting Engineers

Dairyland Power Corporation
Alma Steam Power Station
Alma, Wisconsin
1-390,000 lbs/hr; 1650 psig;
1005/1005F;
Fuel: Pulverized Coal by Riley
#550 Pulverizers
Vern E. Alden Co., Engineers

RILEY Stoker Corporation

WORCESTER, MASSACHUSETTS

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Atlanta St. Louis Kansas City St. Paul Tulsa Houston Denver Salt Lake City Los Angeles San Francisco Portland Seattle

COMPLETE STEAM GENERATING UNITS

AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITIES, INDUSTRIAL POWER AND HEATING PLANTS

ways of making surprisingly large savings in your power costs.

Here's the Central TRANSFORMER CORP. Story:

. . . why you should specify Central for modern made, longer lasting Transformers that give better service

The best-made transformers will always come from factories with the most up-to-date equipment, geared to quality workmanship. That's why Central transformers are recognized across the country as top quality.

Central's ultra-modern, super-efficient new plant at Pine Bluff provides the very latest machinery and methods. This combined with skilled conscientious workmanship will naturally produce the most dependable, trouble-free transformers. It will always pay you to check with Central for your transformer needs.

Features of Central Distribution Transformers

Externally-clamped primary bushing, galvanized hardware, shank extending into oil. Tin-plated bushing terminals.

Buna N Gaskets, seal assured by rolled edge tank and hand hole. Large oval handhole.

Galvanized cast steel cover clamps. Extra heavy gauge cover hold-down and lifting lugs.

Tap changer operating handle above oil level.

Low voltage Spacer Board.

Combination anchoring and untanking lug. Centering boss in base.

Cold-rolled grain oriented core steel.

Folded layer insulation.

Heavy Gauge Stainless steel name plate with bracket designed for easy cleaning and painting.

Adequate coil ducts.

Filled with inhibited oil under vacuum.

Tank finish is shot blast, primer and two finish coats.

Coils are baked after impregnation with heat reactive polymerizing varnish.

Coil blocking, 15 KVA and above.

Flexible Cable Secondary leads, 25 KVA and above.

Also Available:

Primary Class — from 3 KVA to 15,000 KVA, up to 115 KV primary class.
Pole Types — In sizes from 3 through 167 KVA.

CTC NEMA Central TRANSFORMER CORP.

PINE BLUFF, ARKANSAS

Sales Offices in principal cities.

in our plazas,
parking areas, shopping centers and drive-ins
NEWARK AIRPORT
P & K Double and Single Tapered Elliptical Arm type standards installed here have 25 foot mounting heights, TB-2 Transformer Bases and 12 foot arms. Four 20 foot floodlight poles with twin projector assemblies are also installed. They are in perfect harmony with Newark Airport's recently modernized appearance and efficiency.

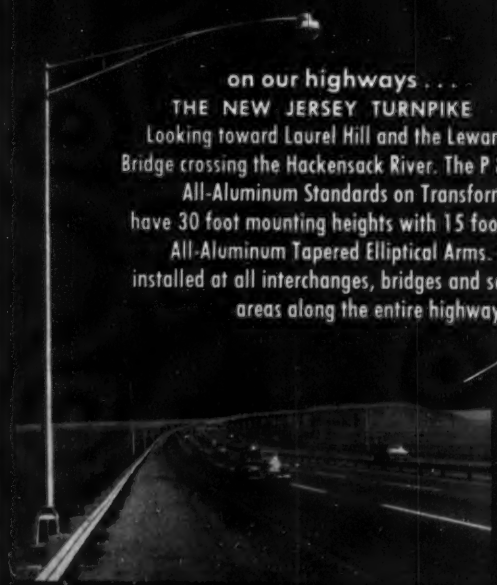
the P&K story

in our communities . . .
LEVITTOWN, PENNSYLVANIA
Scheduled for completion by the end of 1954, Levittown, Pa. will be the state's tenth largest city! Its streets will feature modern, efficient lighting provided by more than 4,000 P & K All-Aluminum Standards and Brackets: 20 foot pendant type with P & K Tapered Elliptical Lighting Arms.

P & K ALL-ALUMINUM STANDARDS AND BRACKETS ARE PRODUCED IN DESIGN AND TYPE TO MEET *EVERY* ROAD, HIGHWAY, AREA OR FLOOD LIGHTING REQUIREMENT. They are always the wisest investment for both efficiency and economy:

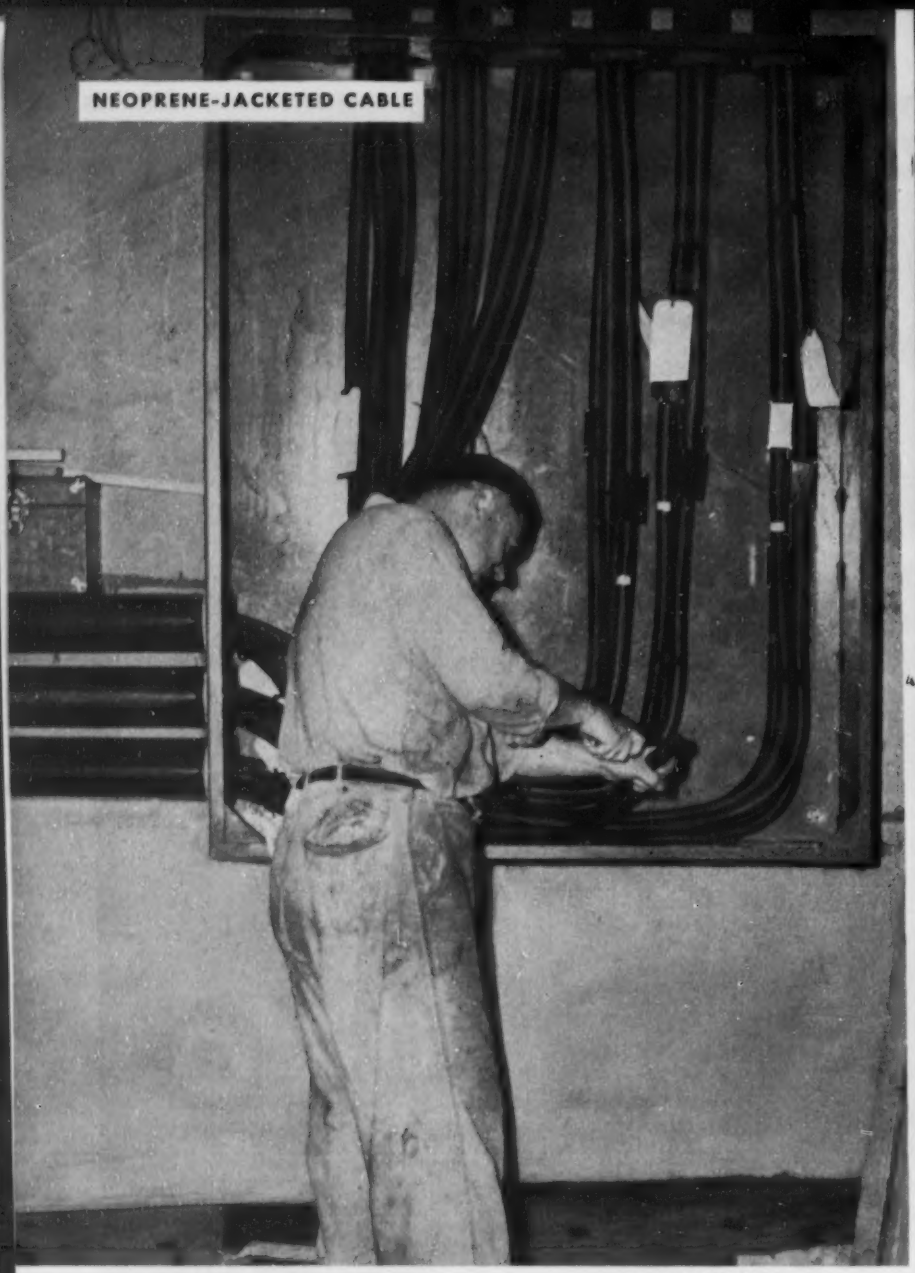
- Much lighter weight for easy handling and low cost installation
- Negligible rate of corrosion for longest service life
- No painting means initial and year-after-year saving
- Easily salvaged and re-used in event of knockdown

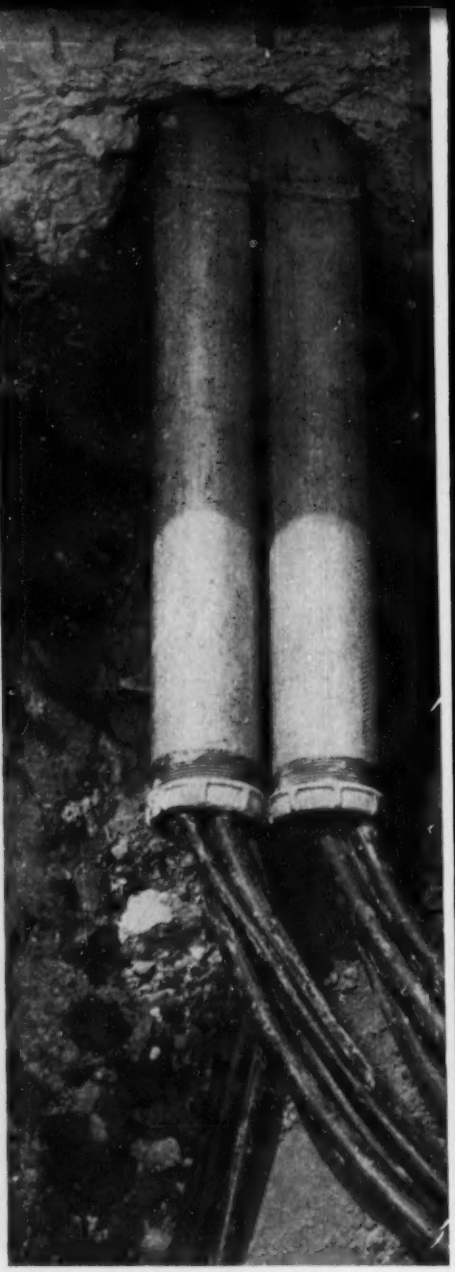
WRITE FOR LATEST P & K CATALOG . . . and use the P & K planning and advisory services without obligation.



on our highways . . .
THE NEW JERSEY TURNPIKE
Looking toward Laurel Hill and the Lewandowski Bridge crossing the Hackensack River. The P & K All-Aluminum Standards on Transformer bases have 30 foot mounting heights with 15 foot All-Aluminum Tapered Elliptical Arms. They are installed at all interchanges, bridges and service areas along the entire highway.

Pfaff & Kendall
84 Foundry Street
Newark 5, New Jersey





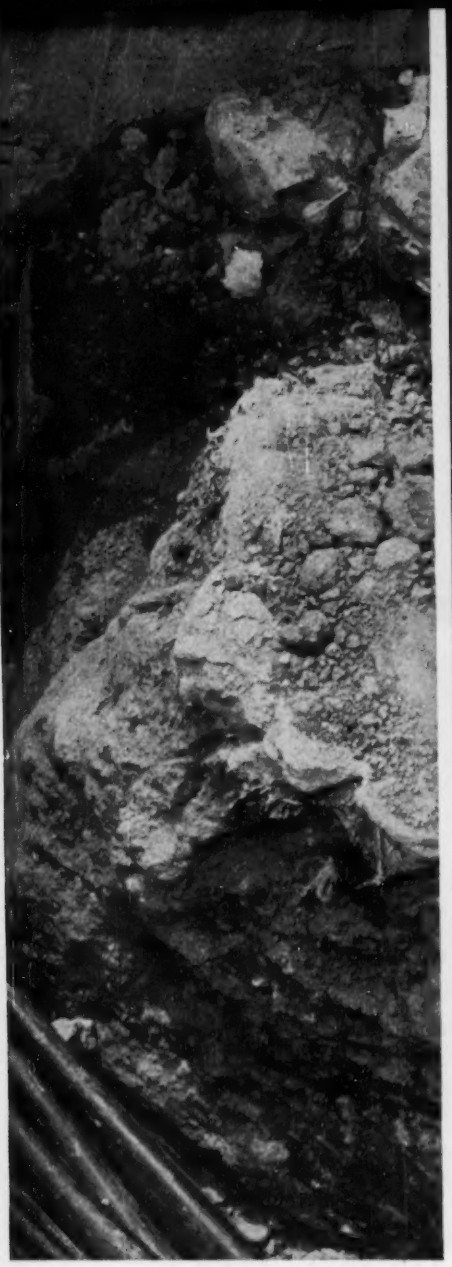
. . . FOR PLANTS

How to get premium wiring for little more

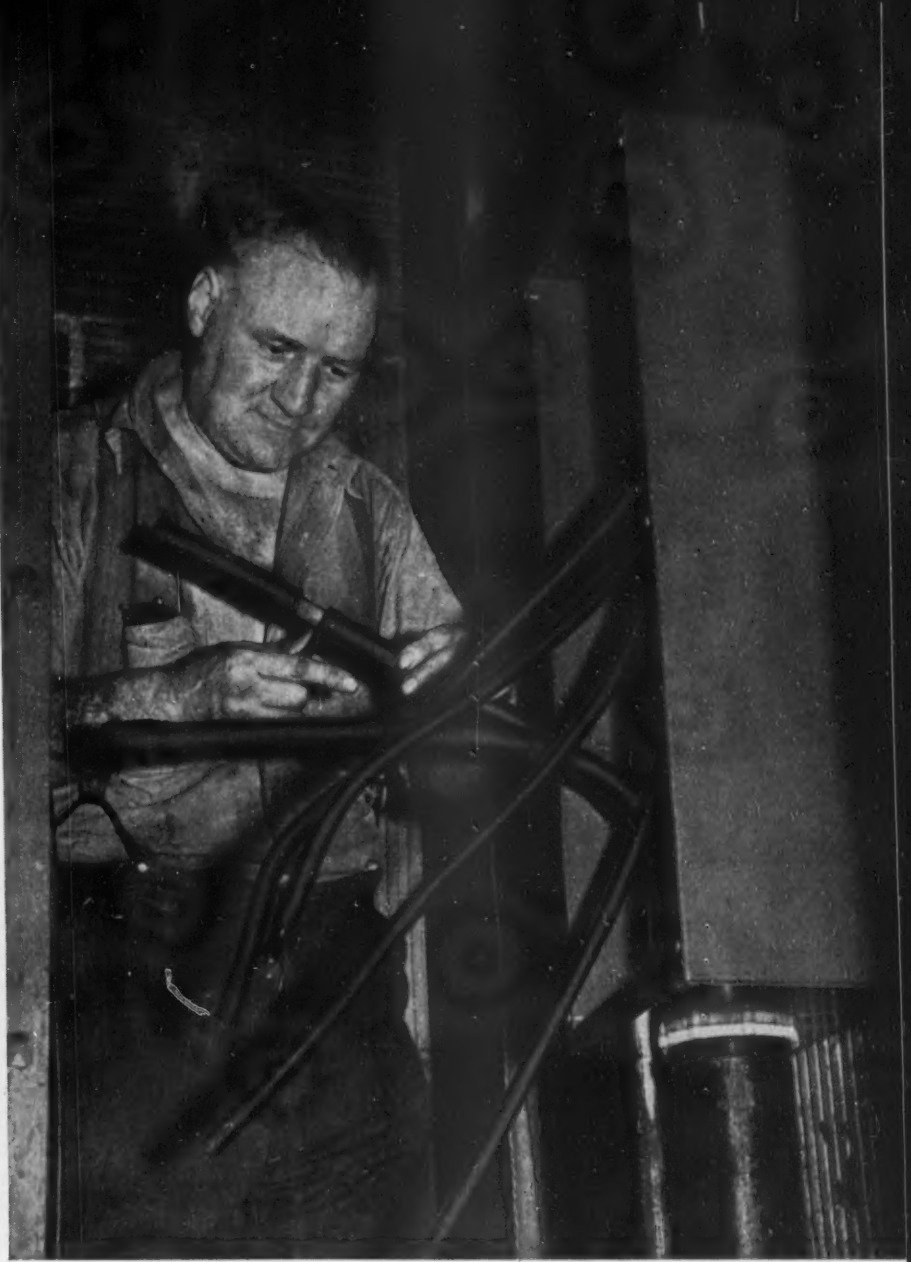
The cable to use is DURASHEATH.
Its actual over-all cost is so little more than the cheapest cable

Wait! Before you buy cable on price alone, see how *little* a premium wiring job actually costs. And what good insurance it is!

When you're wiring up, for power or lighting, the price of wire and cable is but a *fraction* of the over-all cost. Simple arithmetic follows – *it makes very little difference in the total cost of the job* whether you buy



. . . FOR UTILITIES



. . . FOR COMMERCIAL BUILDINGS

than you now pay

the cheapest cable or a premium cable like neoprene-jacketed Durasheath*.

But what a difference there can be in performance!

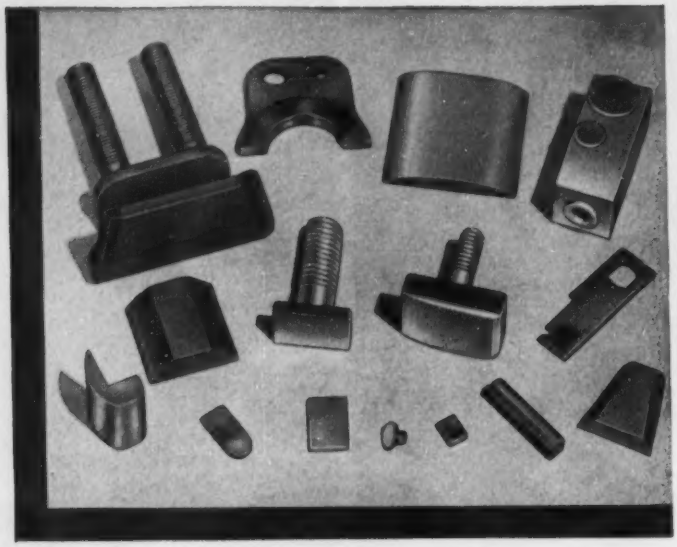
Anaconda's Durasheath is tough . . . heat-resistant . . . long-lasting. Its rugged neoprene jacket resists moisture, chemicals, sunlight, corrosion, electrolysis, abrasion and mechanical injury. It delivers real service dependability year after year.

And Durasheath is good for almost any job you have. You can bury it directly in the ground . . . run it in damp ducts . . . string it overhead . . . in *one continuous run* with minimum splicing. Order through your Anaconda Sales Office or distributor. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

*Reg. U. S. Pat. Off. 54366

ANACONDA®

Primary and secondary distribution cable • building wire • portable cords and cables • mine cable • magnet wire • copper, aluminum, copperweld conductors • signal, control and communication wire • wire and cable accessories.



For Breaking Heavy Currents

ELKONITE® Contacts

Have No Equal

Elkonite contacts give exceptional life and dependability in heavy-duty power interrupting service. They are made of an entirely different type of material, created by Mallory's exclusive techniques in powder metallurgy. In them are merged the refractory and arc-resistant qualities of tungsten, molybdenum or their carbides . . . plus the high current-carrying capacity of copper or silver.

These metals, which cannot be alloyed, are combined in the Elkonite process to produce a unique series of contact materials . . . with an unequalled combination of conductivity, resistance to arc erosion, impact strength and resistance to sticking. They provide characteristics far superior to those obtained with ordinary "powder metal" products.

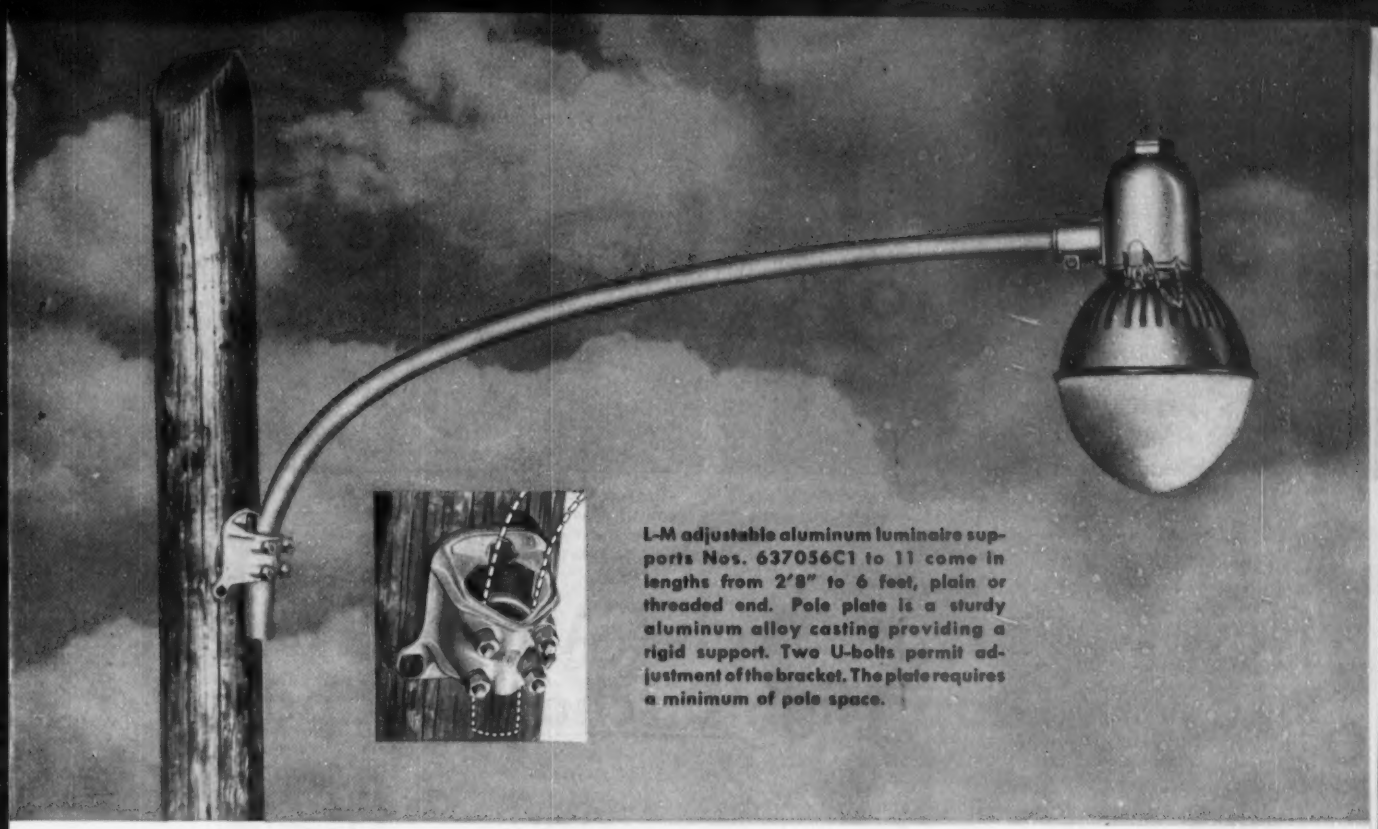
The extensive selection of Elkonite materials offers a wide choice of physical and electrical properties. You're sure to find the exact contact material for your specific product . . . whether it be oil or air circuit breakers, heavy-duty controls, aircraft relays, starting switches or any other power-controlling device. Write today for a copy of the new Mallory Contact Catalog, which details the characteristics of all Mallory contact materials and includes valuable technical and design data.

● *Complete Contact Assemblies*
By manufacturing complete assemblies of contacts and backing members, Mallory can simplify your production and delivery problems . . . often at substantial savings. Write for information.

Expect more . . . Get more from MALLORY

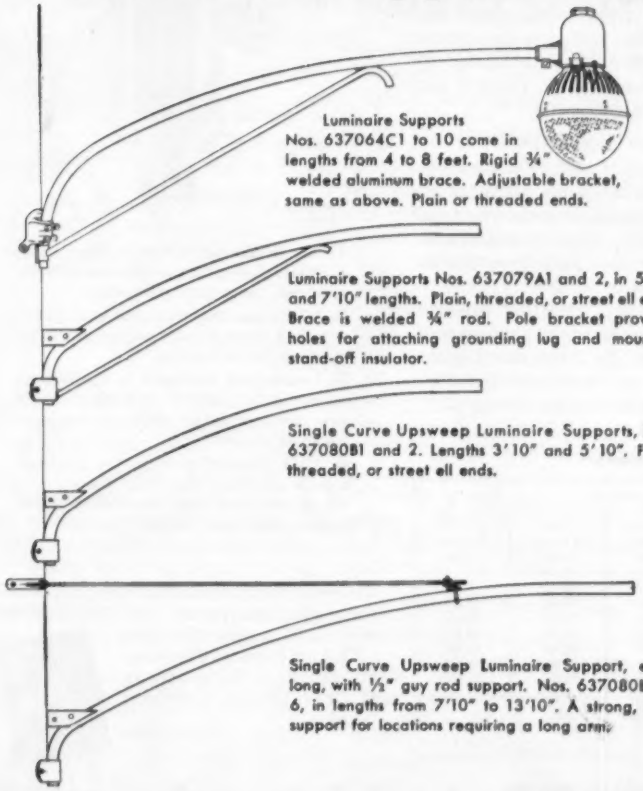
P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials



L-M adjustable aluminum luminaire supports Nos. 637056C1 to 11 come in lengths from 2'8" to 6 feet, plain or threaded end. Pole plate is a sturdy aluminum alloy casting providing a rigid support. Two U-bolts permit adjustment of the bracket. The plate requires a minimum of pole space.

L-M's New Aluminum Luminaire Supports Offer Fine Appearance, High Strength



Luminaire Supports Nos. 637064C1 to 10 come in lengths from 4 to 8 feet. Rigid ¾" welded aluminum brace. Adjustable bracket, same as above. Plain or threaded ends.

Luminaire Supports Nos. 637079A1 and 2, in 5'10" and 7'10" lengths. Plain, threaded, or street ell ends. Brace is welded ¾" rod. Pole bracket provides holes for attaching grounding lug and mounting stand-off insulator.

Single Curve Upsweep Luminaire Supports, Nos. 63708081 and 2. Lengths 3'10" and 5'10". Plain, threaded, or street ell ends.

Single Curve Upsweep Luminaire Support, extra long, with ½" guy rod support. Nos. 63708083 to 6, in lengths from 7'10" to 13'10". A strong, rigid support for locations requiring a long arm.

L-M's new luminaire supports are high-strength aluminum alloy. They require no painting and keep their good looks for years.

Several of these luminaire supports have adjustable mounting plates, which permit easy alignment to compensate for raked poles. Choice of end styles.

Get Complete Information on L-M Street Lighting Equipment

L-M also offers a full line of street lighting luminaires—incandescent, mercury vapor, and fluorescent—and complete street lighting application engineering service. Ask the L-M Field Engineer for information and bulletins. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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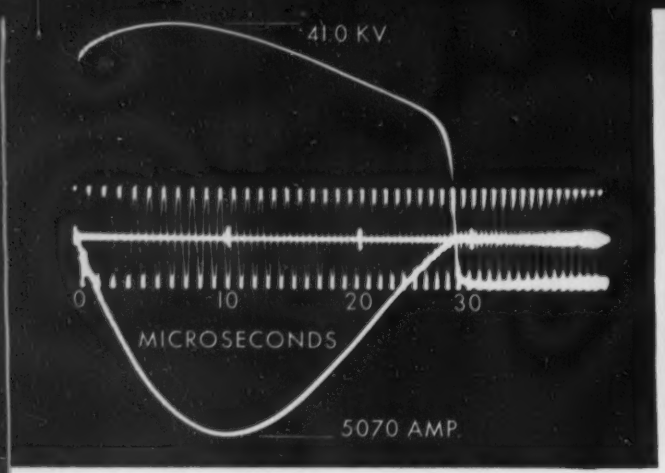
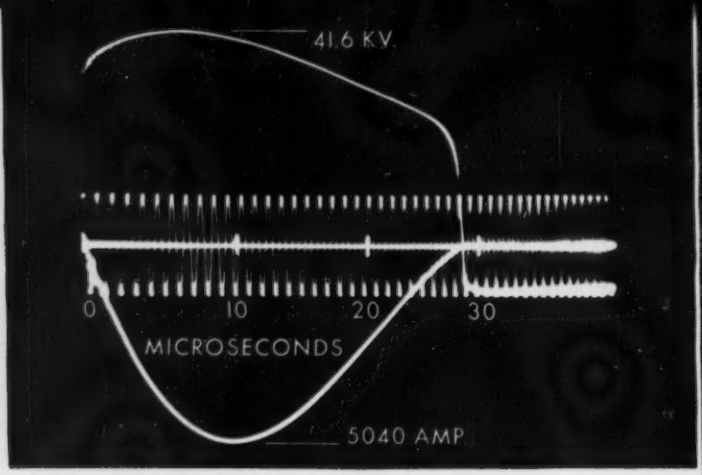
LM LINE MATERIAL

Street Lighting



Before test: Oscillogram illustrates the electrical characteristics of an L-M 9 kv arrester before the AIEE Operating Duty Cycle Test of thirty operations using a 5000 ampere surge and 60-cycle follow current at the rated voltage of the arrester.



After test: Oscillogram of electrical characteristics of the same arrester after AIEE Operating Duty Cycle Test, illustrating the unchanging high degree of protection that is maintained throughout the life of the arrester.

How L-M's Type E Valve Arrester Provides Low IR Drop, High Discharge Capacity

By **GEORGE W. COOPER**
Manager
Protective Equipment Sales
Line Material Company

L-M's exclusive design of valve arresters provides the optimum amount of valve material to give balanced performance. The valve material must provide a low impedance path for surge currents to assure low IR drop, provide ample surge current capacity, and function as a valve to limit follow current until it is interrupted by the series gap.

Several factors contribute to the high discharge capacity or ability of the Type E arrester to handle heavy strokes of lightning without damage.

L-M's Molded-in Valve Element

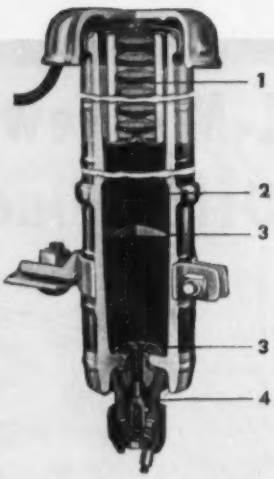
"Granulon," the valve material, was developed as the result of years of experience and research in distribution-type arresters. It is able to withstand severe heating which accompanies heavy strokes of lightning. The "Granulon" is mixed with a special non-charring, inorganic, glass-like binder; then molded directly into the glass housing at high pressure to form a hard, dense mass with outstanding discharge capacity and valve-action properties.

Lens-shaped electrodes are placed in the valve element to counteract the lightning surge current "skin effect." These electrodes have been scientifically designed to produce a multiple-path distribution of the surge current throughout the valve element, thus increasing the discharge capacity of the element and assuring long, uniform life.

Assures High Capacity

The characteristics of L-M's valve element combine optimum performance features with outstanding protection and long arrester life. These characteristics are retained permanently without change caused by aging or service.

In addition, the "Isolator" provides positive assurance against permanent fault to ground by disconnecting the ground lead from the arrester if the arrester should ever become damaged.



1. The ladder spark gap is designed to provide a perfect balance between 60-cycle sparkover and impulse sparkover.

2. "Granulon," the valve material, is able to withstand severe heating which accompanies heavy strokes of lightning.

3. Lens-shaped electrodes in the element counteract "skin effect" of surges, assuring even distribution of the discharge throughout the valve element.

4. L-M's "Isolator" gives positive assurance against grounding feeders by disconnecting the ground lead from the arrester if the arrester should ever become damaged.

Electrical Characteristics of Type E Valve Arrester

KV Rating	Minimum Impulse Sparkover 1½x40 Wave KV Crest	Front of Wave Sparkover KV Crest	IR Drop Across Arrester				
			1500 Ampere Surge	3000 Ampere Surge	5000 Ampere Surge	10,000 Ampere Surge	20,000 Ampere Surge
1	8	8	4 KV	4.5 KV	5 KV	6 KV	7 KV
3	14	17	11 KV	13 KV	14 KV	16 KV	18 KV
6	30	33	22 KV	25 KV	27 KV	31 KV	35 KV
9	42	49	33 KV	37 KV	41 KV	46 KV	53 KV
10	42	49	37 KV	42 KV	46 KV	52 KV	59 KV
12	53	60	44 KV	49 KV	54 KV	60 KV	67 KV
15	63	70	55 KV	62 KV	66 KV	74 KV	85 KV

(On wave rising 100 kv per microsecond per 12 kv arrester rating; 10 kv per microsecond for 1 kv arrester.)

Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer, or write for a copy of Bulletin LA2, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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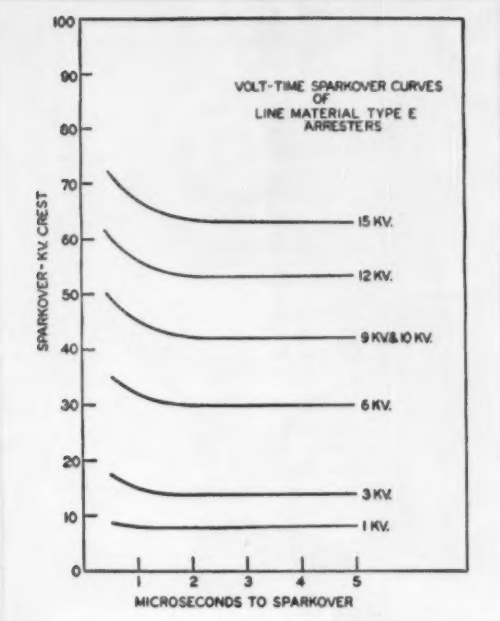
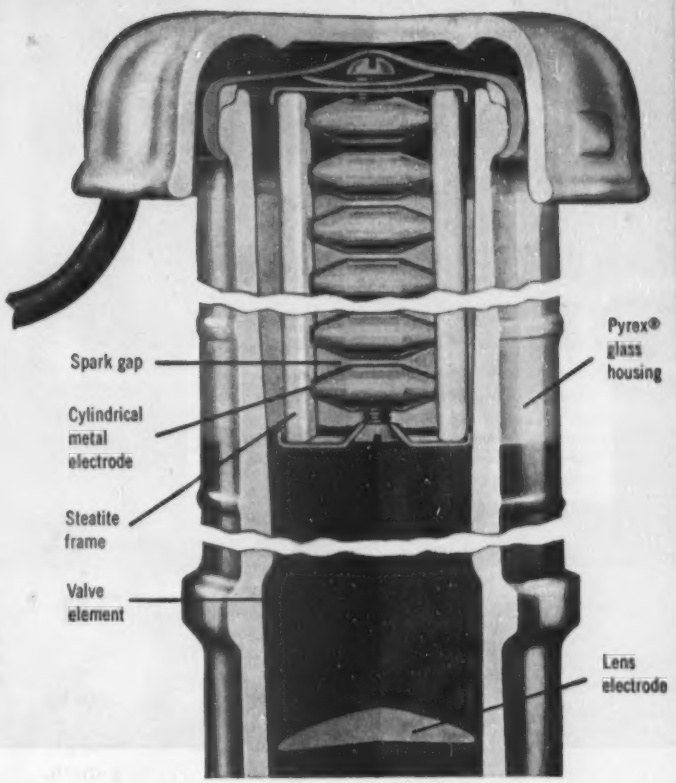
LINE MATERIAL Lightning Arresters



Volt-time curves of arrester sparkover on impulse. These curves illustrate the quick response of the arrester to lightning surges. At all points of the curve the impulse sparkover of the arrester is far below the insulation strength of the distribution equipment being protected.



How L-M's Type E Valve Arrester Balances 60-Cycle Sparkover and Impulse Sparkover

By **GEORGE W. COOPER**
Manager
Protective Equipment Sales
Line Material Company

L-M's Valve Arrester spark gap is designed to prevent unnecessary 60-cycle sparkover of the arrester to harmless switching surges, whereas the low and consistent impulse sparkover brings the arrester into operation quickly and dependably in case of a dangerous lightning surge.

Precision Spark Gap

The spark gap is made of electrode members, accurately spaced and supported by a strong machined frame of high-grade steatite. The gap is so designed that its 60-cycle sparkover value is approximately 1.8 times the rating of the arrester under wet conditions. This is sufficient to keep normal switching surges from sparking over, and provides a path to drain off higher switching and lightning surges.

At higher surge voltages the combination of the metal electrode and the steatite produces an instantaneously ionized, electrically fast path. This combination, together with the cylindrical design of the electrodes, forms a ladder gap unit with a low impulse sparkover.

High Discharge Capacity

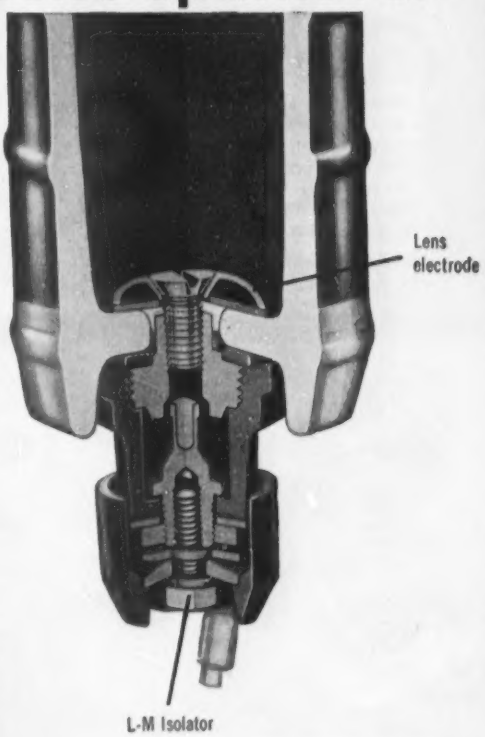
L-M's exclusive bonded valve element combines low IR drop with more than enough capacity to handle the 65,000-ampere surges prescribed by NEMA. It acts as a valve to limit power follow current to a negligible value.

The result of all these features is that the L-M Type E arrester is outstanding in the protection it provides, in its long life under severe lightning conditions, and in its permanent, never-changing characteristics. L-M valve-type arresters amply meet all NEMA standards.

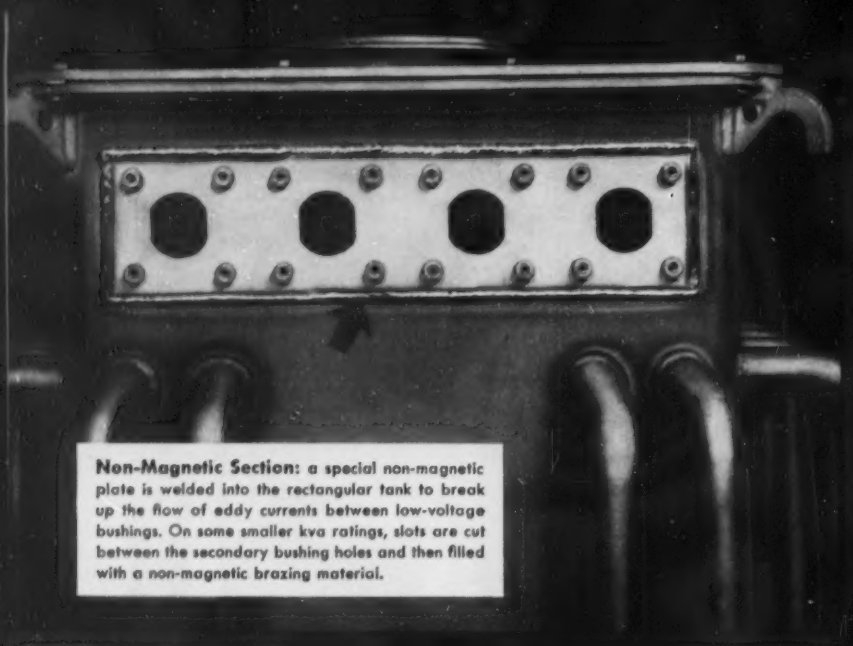
In addition, L-M's "ISOLATOR" provides positive assurance against grounding feeders, by disconnecting the ground lead from the arrester, if the arrester should ever become damaged.

Get This Bulletin

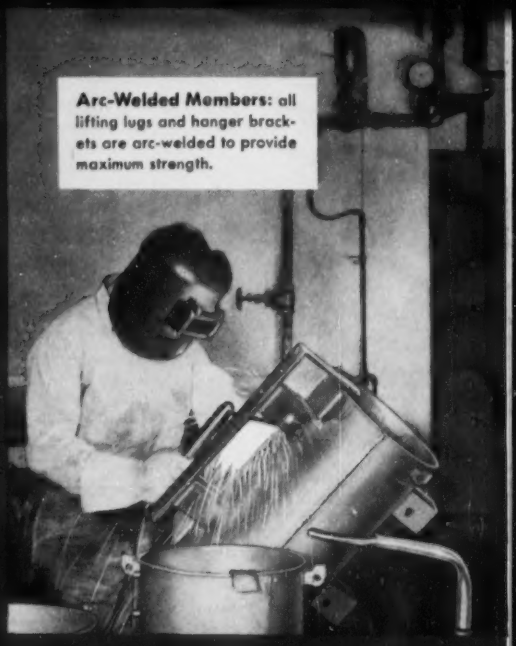
Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer for a copy of Bulletin LA2; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



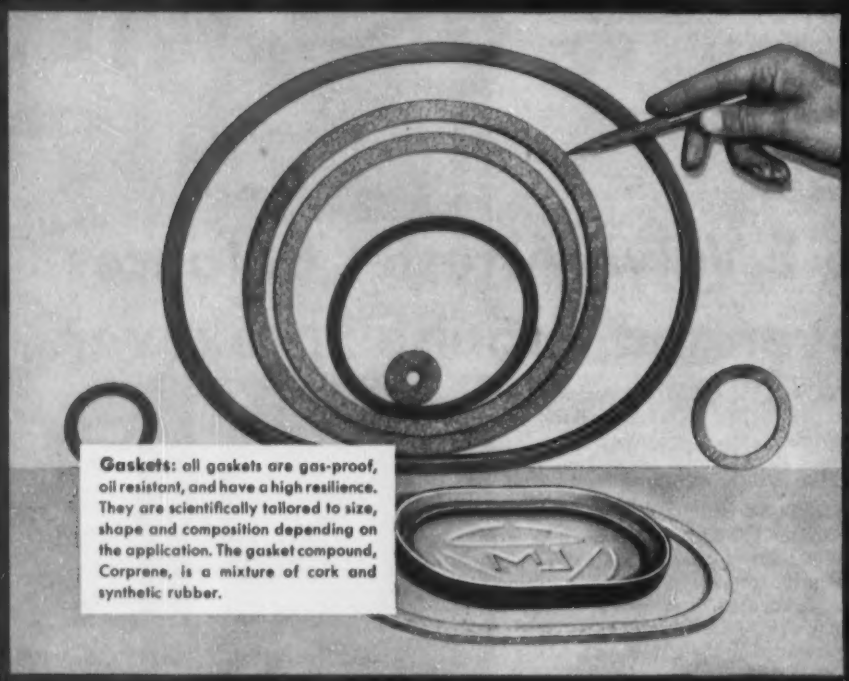
LINE MATERIAL Lightning Arresters



Non-Magnetic Section: a special non-magnetic plate is welded into the rectangular tank to break up the flow of eddy currents between low-voltage bushings. On some smaller kva ratings, slots are cut between the secondary bushing holes and then filled with a non-magnetic brazing material.



Arc-Welded Members: all lifting lugs and hanger brackets are arc-welded to provide maximum strength.

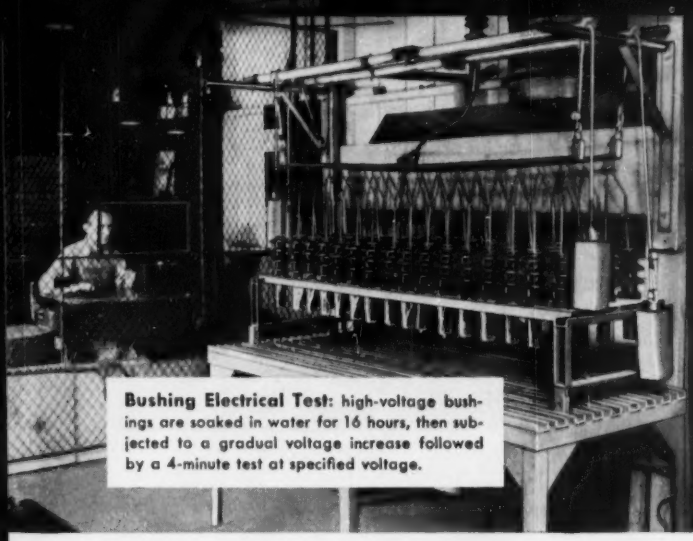


Gaskets: all gaskets are gas-proof, oil resistant, and have a high resilience. They are scientifically tailored to size, shape and composition depending on the application. The gasket compound, Corprene, is a mixture of cork and synthetic rubber.

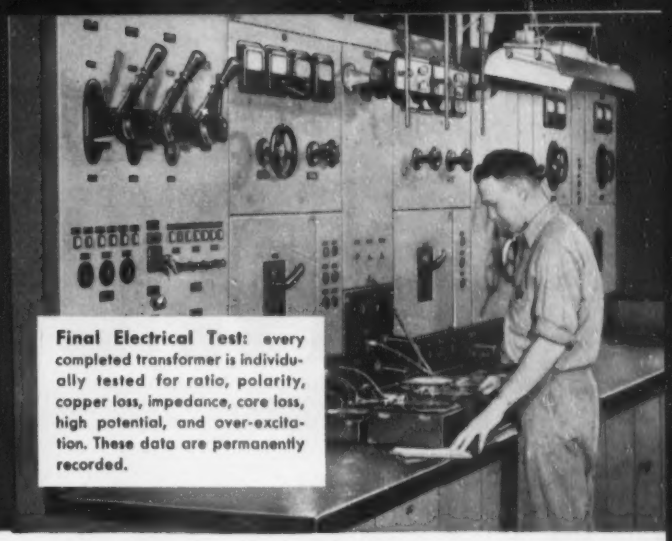
Caulking Hanger Brackets: the crevices on the inside corners are filled with an alkyd-base caulking compound to keep rust and corrosion from attacking the tank metal behind the bracket.

Stainless Steel Bolts: the cover bushings are all secured with stainless steel, rust-proof bolts. You can easily remove or replace the bushings at any time.

Special Lock Screw: the tap changer has a special lock screw with nylon insert which is completely unaffected by vibration.



Bushing Electrical Test: high-voltage bushings are soaked in water for 16 hours, then subjected to a gradual voltage increase followed by a 4-minute test at specified voltage.



Final Electrical Test: every completed transformer is individually tested for ratio, polarity, copper loss, impedance, core loss, high potential, and over-excitation. These data are permanently recorded.

L-M's Round-Wound® Transformers Have

"The Little Things That Count"

By J. G. EVERHART
Chief Engineer
Transformer Division
Line Material Company

L-M Round-Wound transformers offer outstanding performance characteristics which are largely the result of the unique wound core and round coils wound directly onto the core.

In addition to this design advantage, L-M exercises particular care in the many "little things that count."

L-M engineers and production personnel are specialists in distribution transformers. Thus, any problem in the design, manufacture, or application of distribution transformers, regardless of how minor it may seem, merits their consideration and specialized knowledge.

Experience has shown that this attention to the details in design, assembly, inspection, and testing adds appreciably to the service life of the Round-Wound transformer, to its exceptionally low failure rate, and to its over-all performance characteristics.

Get The Whole Story On Round-Wound Transformers

A 16mm. color-sound motion picture film is available for showing to members of your organization, illustrating the construction of L-M Round-Wound transformers and the care taken in "the little things that count." Ask the L-M Field Engineer for complete information, or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

Some of the Little Things That Count for the User

COIL:

Each coil is tagged, identifying rating, winder, wire manufacturer . . . assures control for better quality.

Extra low voltage ties . . . give added axial short circuit strength.

Varnish dip . . . provides excellent mechanical strength under short circuit.

Vacuum oil impregnation . . . assures corona-free operation and uniformly high dielectric strength.

TANK:

Everdur cover bolts (large rectangular tank units) . . . eliminate rusting, provide high mechanical strength.

Stainless steel mounting bolts—cover bushings . . . facilitate bushing removal or replacement; no rusting.

Self-locking anchor nuts . . . secure the core and coil assembly against vibration or other accidental loosening.

Scientifically selected Corprene (TM) gaskets... combine gas proofness and oil resistance with proper resilience for quality seal.

Arc-welded lifting lugs and hanger brackets . . . assure positive and permanent strength of load-carrying parts.

Caulked hanger brackets . . . prevent exposed-crevice corrosion.

Non-magnetic slots and plates in tank wall . . . reduce eddy current losses.

Petroleum jelly on secondary spades . . . prevents corrosion.

SMALL TAP CHANGER:

Fiber glass reinforced alkyd resin body . . . lengthens vertical creepage paths from line to ground.

No live parts on top of tap changer . . . increases safety.

Self-aligning line lead knob for hand tightening . . . provides maximum torque with minimum effort. Impossible to cross thread. No tools necessary.

EXTERNALLY OPERATED TAP CHANGER:

"Lifetime" Teflon (TM) shaft seal. Non-corrosive external parts. Positive positioning locking device. Self-aligning, self-wiping contacts. Stainless steel shaft.

All these features eliminate corrosion, prevent binding, assure positive, low-resistance connections, and help provide a long-lasting, smooth-operating mechanism.

TESTING:

Steel and wire acceptance tests and controls. 100% primary bushing electrical test. 100% preliminary core loss test. 100% preliminary coil ratio and polarity test. Core and coil assembly test. Leads and connections mechanically and electrically tested. Casing inspection. Power factor test.

These are examples of in-process quality control leading to over-all quality of a uniformly high level.

Final electrical line test. 100% testing for ratio, polarity, copper loss, impedance, core loss, high potential and over-excitation. Thorough testing of completed unit before shipment is final step in control for better quality.

Test records and data kept permanently on file . . . make complete design and test information always available.

Oil leak test . . . assures oil-tight welds and positive seals and gasketing.

GENERAL:

Terminals tin coated . . . gives low resistance; minimizes galvanic action when aluminum wire is used.

Swaged connections . . . have low resistance; are mechanically secure.

Inspection tags . . . assure complete checking at 4 prime stations coded for identification.

Oil-impregnated, kiln-dried, maple coil support blocks . . . assure high mechanical strength with no possibility of subsequent loosening.

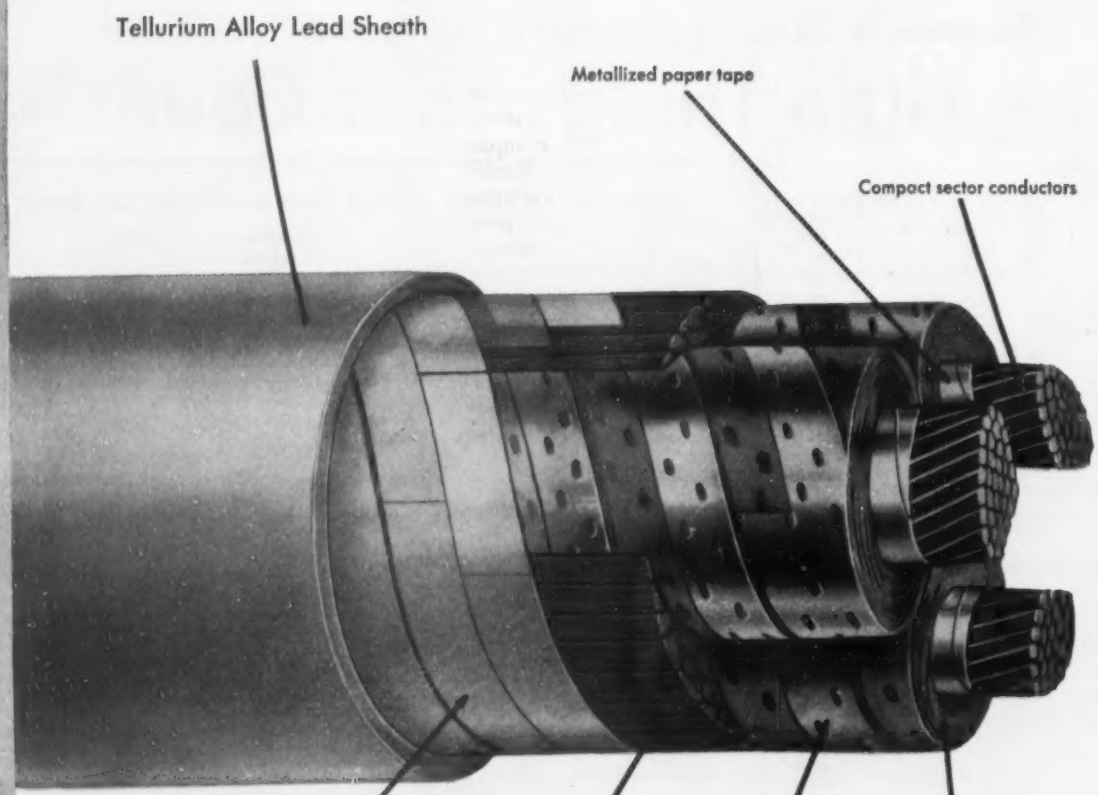
Temporary plastic covers (small units) . . . prevent contamination during fabrication.

ORTO-inhibited oil . . . prevents sludging, increases life expectancy of oil.

LM® LINE MATERIAL Transformers

NEW TELLURIUM ALLOY LEAD SHEATH

IT'S A ROEBLING


Tellurium Alloy Lead Sheath
Metallized paper tape
Compact sector conductors
Perforated copper tapes over each conductor insulation
Intercalated paper and bronze tape belting
Saturated paper fillers
Wood pulp paper, oil impregnated

BRINGS 4 BIG ADVANTAGES AND EXCLUSIVE!

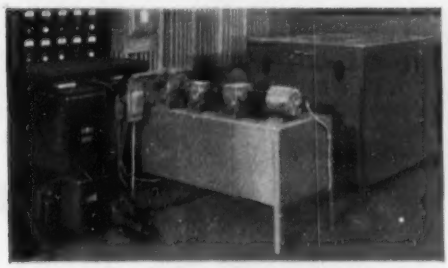
ROEBLING IS NOW READY to fulfill your requirements for Paper Insulated Power Cable with the new Tellurium Alloy Lead Sheath . . . the perfect and *economical* answer to four serious power cable problems.

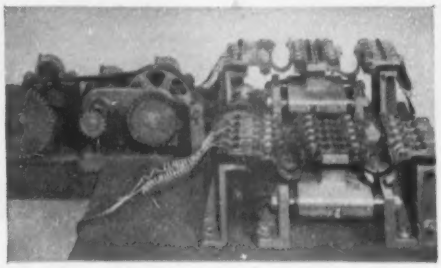
Tellurium Alloy Lead Sheathed Paper Insulated Cable has a lower long-time creep rate. It has extra high fatigue resistance. This cable has high bursting strength. It has remarkable stability under heat application as in duct splicing and wiping.

In addition, it does away with the need for frequent and expensive segregating stop joints or costly reinforced lead sheaths . . . does not require extra-liberal expansion bends or large manholes . . . its bursting strength is far superior to that of any other cable sheath alloy . . . heat application at joint end wipes and similar locations leaves its desirable properties unimpaired.

Roebling Paper Insulated Cable with Tellurium Alloy Lead Sheath is now in full production. Practical experience has confirmed laboratory findings that this new sheath brings a combination of physical characteristics that assures new measures of performance and unmatched economy.

WRITE US FOR FULL DATA. John A. Roebling's Sons Corporation, Dept. 707, Trenton 2, N. J.





Some of the specially-developed testing equipment with which Roebling maintains quality control of the production of Tellurium Alloy Lead Sheath. (At left) Lead strip fatigue testing at controlled temperature. (At right) Lead strip fatigue testing at room temperature.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. & 5 PITTSBURGH ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, ROOM 239, HENRY W. OLIVER BLDG. • ROCHESTER, 1 FLINT ST. • ST. LOUIS, 3001 DELMAR BLVD. • SALT LAKE CITY, 536 W. 8TH SOUTH ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST. AVE. S. • TULSA, 331 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

EXCEEDS CLASS III SPECIFICATIONS

Wet or dry, pick your flashover test, NEW Kimble *Tempered* Glass insulators show flashover resistance exceeding A.I.E.E. requirements. In puncture tests, too, *Tempered* Glass insulators are outstanding. It has proved impossible to puncture them in air, even under the most severe maximum voltage impulses applied. Four years of field testing on more than 500 miles of line have produced no puncture failure. Even lightning surges have failed to damage them.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required. This great strength saves installation time because it's never necessary to loosen for line up with the conductor—they can always take another quarter-turn.

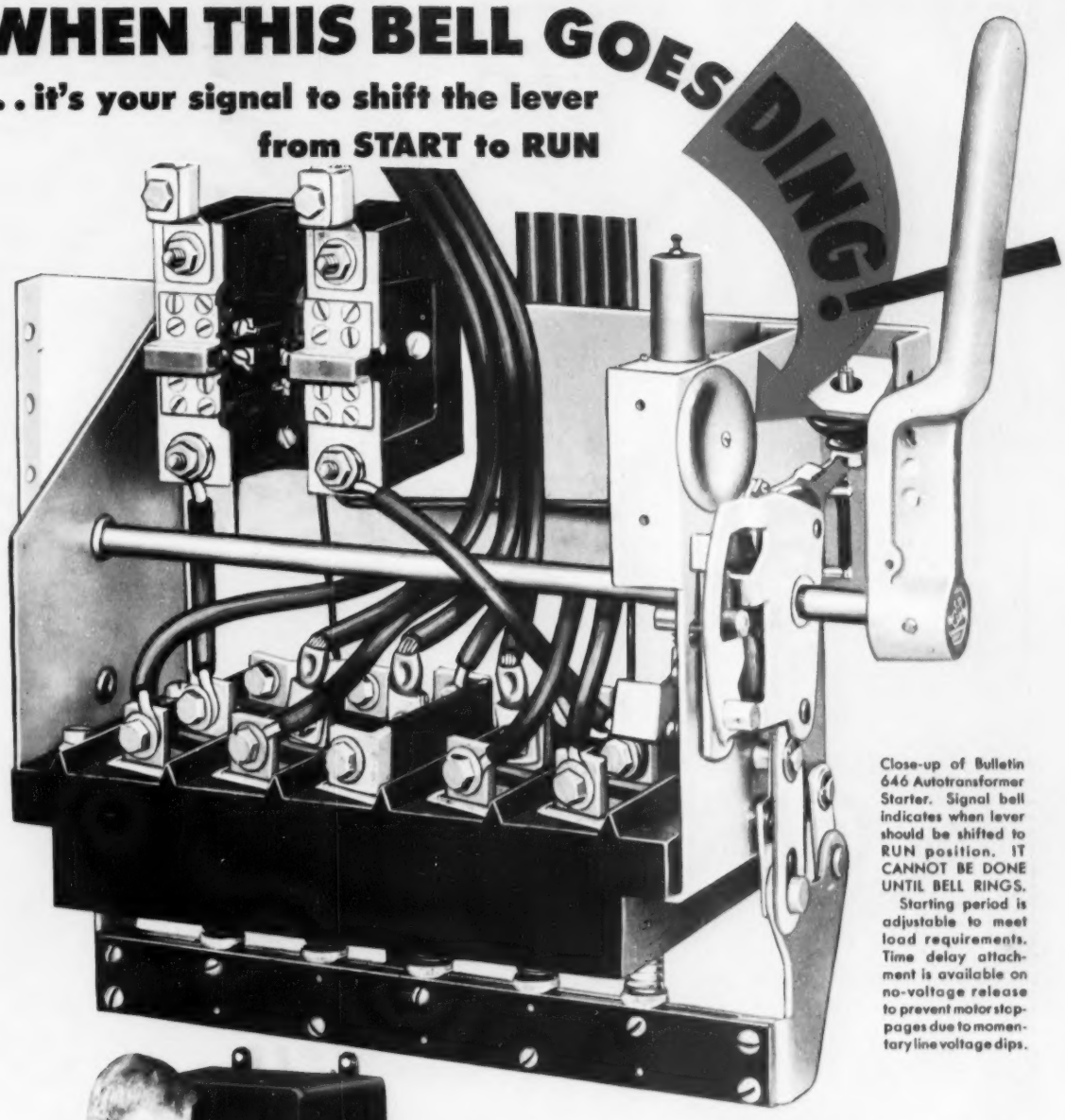
Why not see how *tempered* glass can cut your line maintenance costs. Write for folder. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-11, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

WHEN THIS BELL GOES DING!

. . . it's your signal to shift the lever from START to RUN



Close-up of Bulletin 646 Autotransformer Starter. Signal bell indicates when lever should be shifted to RUN position. IT CANNOT BE DONE UNTIL BELL RINGS.

Starting period is adjustable to meet load requirements. Time delay attachment is available on no-voltage release to prevent motor stoppages due to momentary line voltage dips.

Operator listening for signal bell which indicates when to throw lever into RUN position.

Air-break Contacts up to 75 HP, 220 V; 150 HP, 440-550 V

The outstanding feature of the Allen-Bradley Bulletin 646 Autotransformer Starter—in Sizes A, B, & C—is the use of silver alloy, air-break contacts. They do away with oil tanks and messy contact maintenance. Only the Size D starter—rated up to 250 hp, 440-550 v—requires oil-immersed contacts.

Send for Bulletin 646 giving complete details on this popular line of reduced voltage squirrel cage motor starters.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Limited, Galt, Ont.

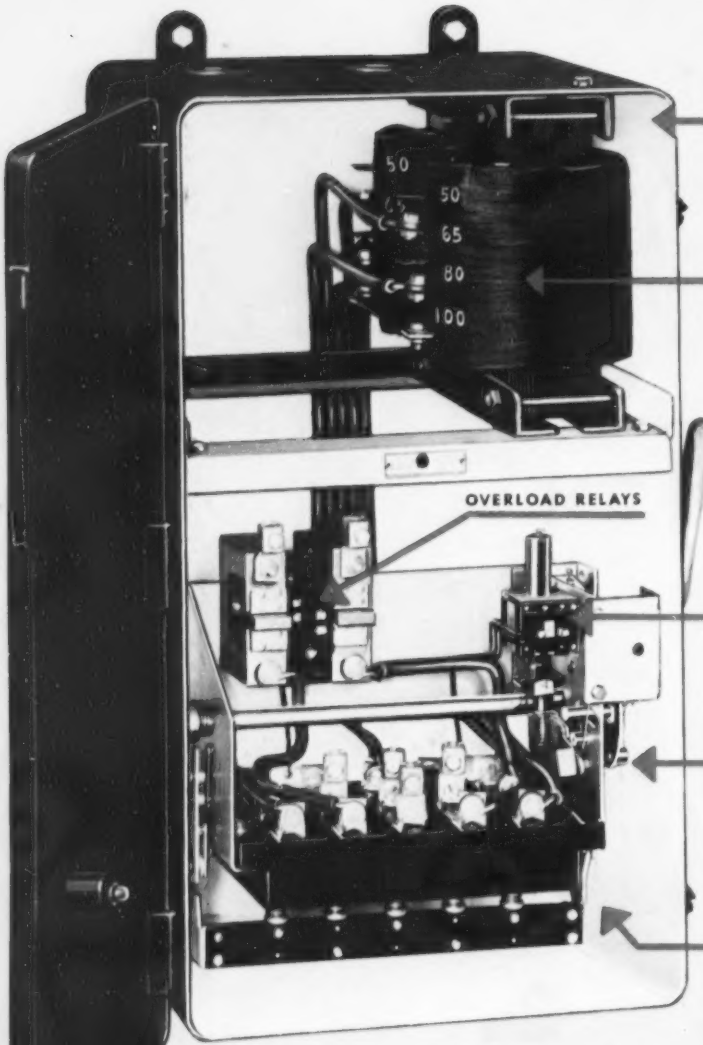
9-54-M

A-B Quality

ALLEN-BRADLEY

BULLETIN 646 AUTOTRANSFORMER STARTER

QUALITY



This starter is equipped with two Bulletin 816 Automatic Reset Overload Relays that give accurate and dependable overload protection for the motor.

ENCLOSURES WITH WHITE INTERIORS
White enameled inside walls of the starter cabinet reflect light on the switch mechanism, making installation and inspection easy even in dark plant locations.

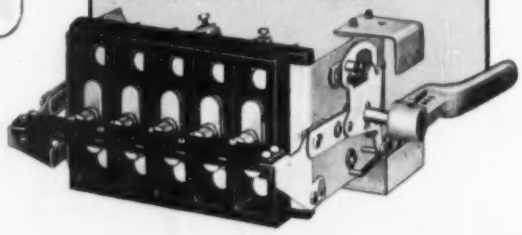
THREE-PHASE AUTOTRANSFORMER
The double winding, open-Delta-connected 3-phase autotransformer has 50%, 65%, and 80% reduced voltage taps. Starting voltage can be easily adjusted to suit the load.

MANUAL OPERATING LEVER
The operating lever is mechanically interlocked with a simple latch which forces the operator to pull the lever into the START position before throwing it into RUN position.

MAGNETIC HOLD-IN LATCH
Contacts are held in the RUN position by a solenoid-operated latch which drops out in case of voltage failure and opens the starter contacts. Operator must restart the motor.

TIME DELAY SWITCHOVER
An adjustable vacuum cup can be set for any starting period from 0 to 15 seconds. Hand lever cannot be pushed into RUN position until the preset starting interval has elapsed.

DOUBLE BREAK, SILVER ALLOY CONTACTS
Here are shown the movable contact bar and the stationary contact block. The double break, silver alloy contacts have long, maintenance free life. No oil needed.



BULLETIN 646 STARTER

HAS AIR-BREAK CONTACTS up to 75 HP, 220 V; 150 HP, 440-550 V

GOOD NEWS . . . Bulletin 646 Autotransformer Starters are available with AIR-BREAK contacts in ratings up to 75 hp, 220 v; and 150 hp, 440-550 v. Only Size D starters require oil-immersed contacts for motors up to 250 hp. The oil-immersed construction can be supplied, however, in Sizes A, B, and C, but their use should be limited to the types of installations which require oil-immersed contacts.

The extraordinary advantage of air-break contacts accounts for the booming popularity of the Sizes A, B, and C starters in the Bulletin 646 line. The silver alloy contacts remain in good condition without filing, cleaning, or dressing. Send for Bulletin 646, which gives all the facts about these remarkable starters. They are the only modern starters of this type on the market.

ALLEN-BRADLEY
QUALITY
BULLETIN 646 AUTOTRANSFORMER STARTER

A-B Quality

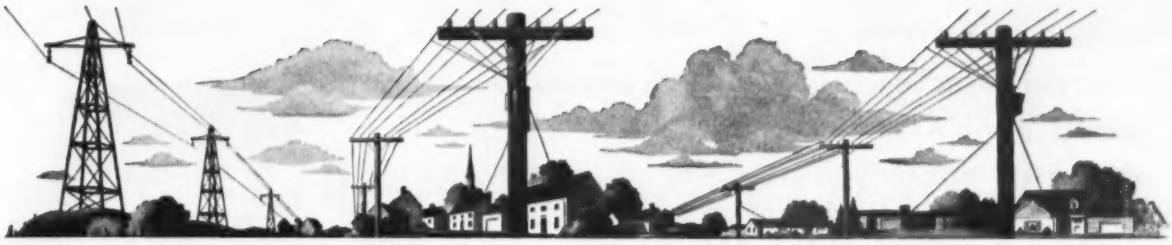
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

In Canada — Allen-Bradley Canada Limited, Galt, Ont.

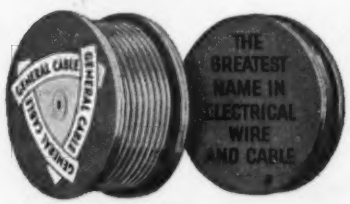
9-54-M

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

BARE **WEATHERPROOF** **SERVICE DROP**



BACKED BY 71 YEARS OF RESEARCH...



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

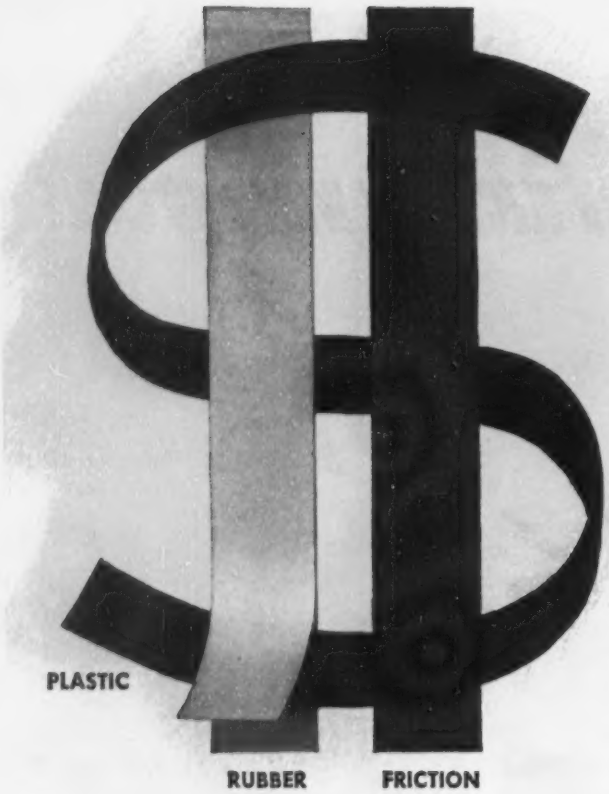
BARE ... is available in regular copper, TENSILOK copper, copperweld, aluminum, ACSR, brass or bronze conductors according to your need.

WEATHERPROOF ... is available in a wide variety of types. Textile covered (O.K. double and triple braid and Peerless type). Neoprene covered (Tip-Top type) and polyethylene covered.

SERVICE DROP ... is available with any type of conductor, with rubber or neoprene insulation and as aerial, self supporting and messenger types with 2 conductors covered with polyethylene or neoprene and 1 bare conductor. Because of light weight they are easy and fast to install. Check General Cable today for your requirements.

GENERAL CABLE CORPORATION

420 Lexington Ave., New York 17, N. Y. • Sales Offices: Atlanta • Boston • Buffalo • Chicago Cincinnati • Cleveland • Dallas • Denver • Detroit • Erie (Pa.) • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Los Angeles • Memphis • Milwaukee • Minneapolis • New York Newark (N. J.) • Philadelphia • Pittsburgh • Portland (Ore.) • Richmond (Va.) • Rochester (N. Y.) • Rome (N. Y.) • St. Louis • San Francisco • Seattle • Syracuse • Tulsa • Wash., D. C.



Extra DOLLAR VALUE IN GOLD SEAL TAPES

Gold Seal **PLASTIC** electrical tape, for example, gives you more "coverage" per roll. A few neat wraps and the job's finished — gives all needed dielectric on most jobs. Single 60 ft. rolls, cellophane protected, are packed in round metal cans. "Tape-saver" 20 ft. rolls, sized to meet average job needs and "swing" easy in tight places, are packed in 10-roll Handy Pack containers. Sample free on request. Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Also Diamond Seal Friction and Rubber Tapes made to ASTM specifications. Products of Jenkins Bros. — makers of famous Jenkins valves.

ANDERSON *dependability turns on the lights...*

In Chicago . . . Prairie View or Portland . . . when the lights go on, *no one asks "how" or "why".* It's a miracle that's taken for granted. No one sees or cares about the countless connections from lead-in cables to transformers, from transformers to main line . . . and on back to sub-stations and power plants. *Not anybody, except the power company men whose responsibility it is to assure the community an uninterrupted flow of electricity.*

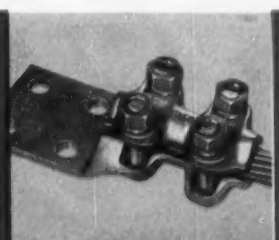
ANDERSON is one of the makers of connectors, who shares this responsibility with the power men.

ANDERSON DEPENDABILITY is a *standard,* trustingly recognized by the country's leading power companies, and held as "guide" in the selection of *any* clamp, connector, fitting or accessory. When engineers specify ANDERSON *they guarantee extra dependability and longer service life.*

Another point . . . from generator to service entrance, ANDERSON is the only manufacturer who makes all the connectors required.

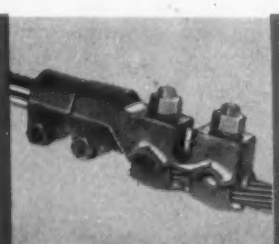
TYPE AS . . .
ALUMINUM SUSPENSION CLAMP

For ACSR with straight, tapered or preformed aluminum armor rods. No liners required.



TYPE SWH . . .
BRONZE SWITCH CONNECTOR
Cable to Flat

For connecting various size copper cables to switches and other electrical equipment.



TYPE BSCH . . .
BRONZE STUD CONNECTOR

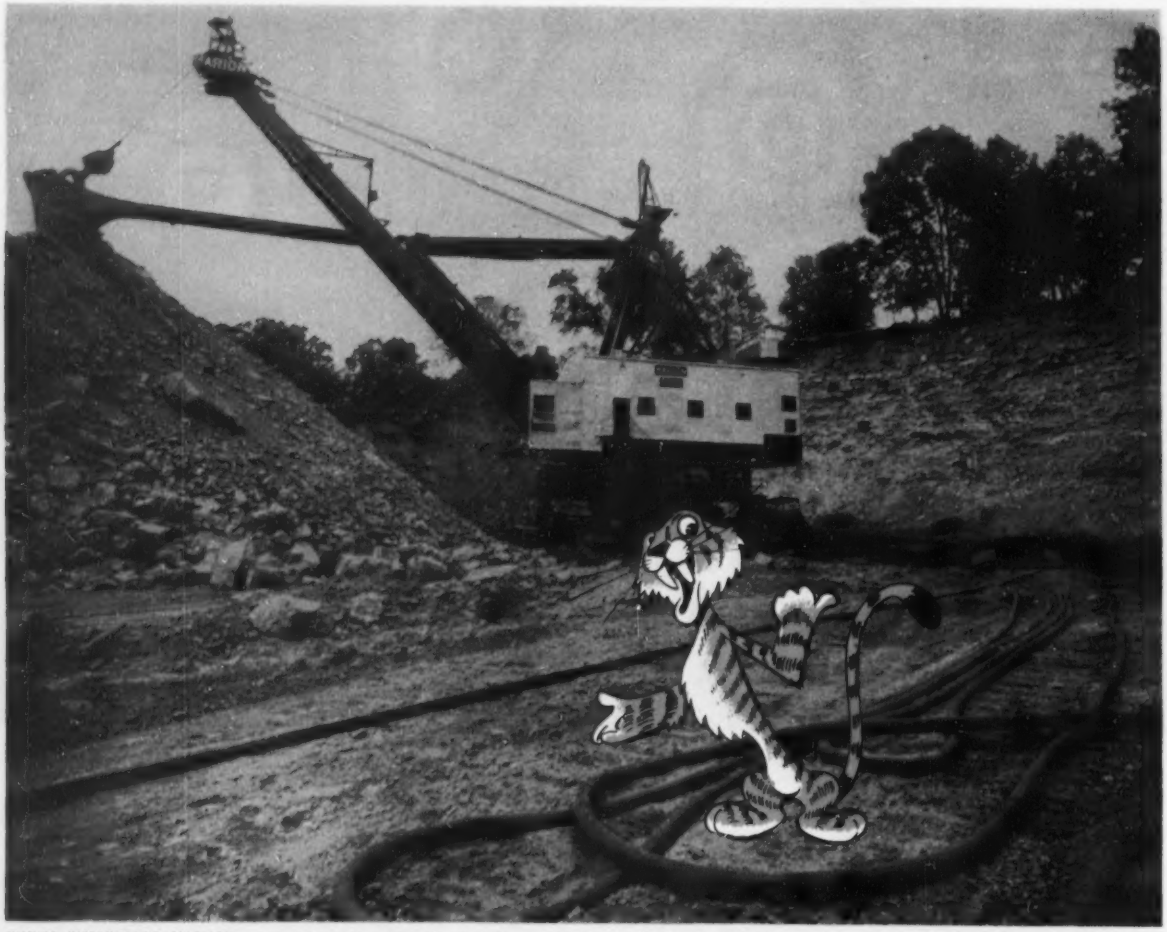
For connecting copper cable to threaded bushing studs. For transformers, oil circuit breakers and other similar equipment.

ANDERSON

BRASS WORKS, INC.
BIRMINGHAM
ALABAMA

FOR MORE COMPLETE INFORMATION consult your nearest ABW representative or contact our home office.

They needed a top quality cable



THE 18-CUBIC-YARD SHOVEL moves a lot of overburden in a hurry. It is supplied with 7500 feet of 3-conductor 1/0 Tiger Brand Amerclad.

HERE IS THE MINE HEADQUARTERS. Wash tower is at center. Notice conveyor system at right that goes to power station over the hill.

like *Tiger Brand* for this high production strip mine

HERE IS A PORTRAIT of the 45-cubic-yard shovel that has removed most of the overburden at this mine.

IF you take a ride out near Zanesville, Ohio, someday, you'll spot the new Muskingum Mine—probably the most modern strip mine in the world. It supplies coal for the new 400,000 kw Muskingum River Plant of The Ohio Power Company, part of the American Gas and Electric System.

The big 18 and 45-cubic-yard electric power shovels operate day and night through sun, rain or snow. And when you consider the eye-popping cost of lost production time, it's easy to see why these shovels need the most dependable power cable on the market. At this mine, it's 100% Tiger Brand Amerclad.

The cable is always exposed to foul weather and accidental abuse. It often stretches for more than a *mile* from switchgear to shovel take-up reel. Yet, after more than 2 years on the job, the Tiger Brand Amerclad is in perfect condition without sign of wear.

If you need a cable that can *take it* . . . if you want cable for a power shovel, dredge, mine locomotive, welding machine or a heavy-duty electrical hand tool—you'll get more for your money if you specify Tiger Brand Amerclad. Drag it through puddles, over sharp rock; spill gasoline or oil on it and expose it to sun and ozone. Tiger Brand will still give you service you never thought possible. *Send the coupon.*

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

paper & varnished cambric cable	shovel & dredge cable
asbestos wire and cable	mold cured portable cord
aerial, underground & submarine cable	machine tool & building wire
	special purpose wire & cable

—SEND THE COUPON—

American Steel & Wire Division
Room EE-104, Rockefeller Building
Cleveland 13, Ohio

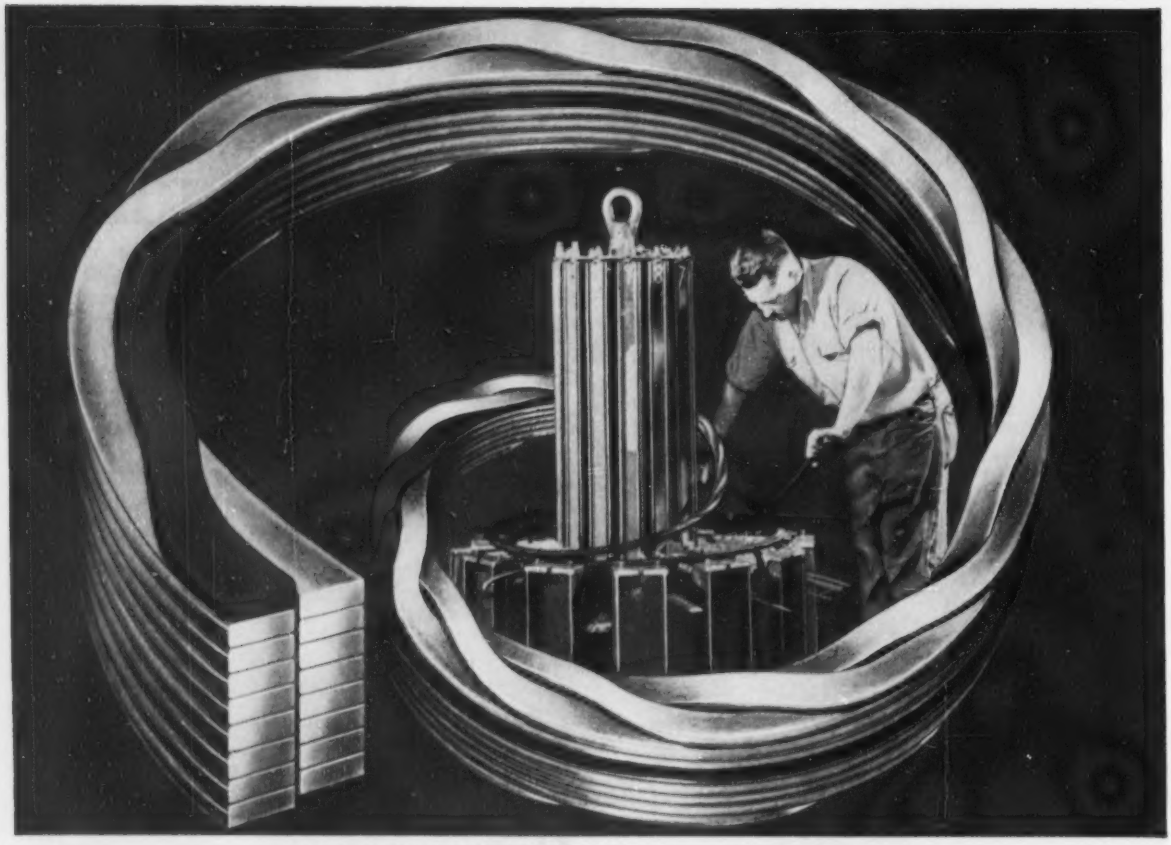
☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

Name .....
Firm .....
Address .....
City ..... State .....

USS Tiger Brand ELECTRICAL WIRE & CABLE

USS

UNITED STATES STEEL



G-E CURRENT-LIMITING REACTORS have continually transposed rectangular conductors that result in a better conductor space factor.

5 good reasons for buying G-E reactors

1. **LONG LIFE** Non-aging concrete supports maintain proper electrical clearances between turns. General Electric reactors do not rely on conductor coverings of aging types for turn-to-turn insulation.

2. **COMPACTNESS** Rectangular transposed conductors, an exclusive G-E feature, permit better conductor space factor—decrease volume of reactor by as much as 20%. Reactors fit in smaller places, save floor space.

3. **PROTECTION** Non-aging glass tape on the conductor serves as a barrier to prevent foreign objects from causing turn-to-turn short circuits.

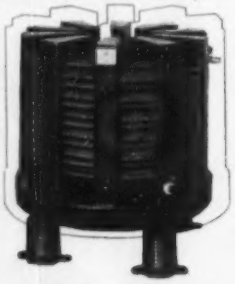
4. **AVAILABILITY** Thanks to our "repetitive-manufacture" production methods, we can meet any reasonable reactor shipment requirements.

5. **ECONOMY** Save 10% by specifying reactors with aluminum conductors. The same high-quality performance standards will be obtained as with copper conductors.

HERE ARE ADDITIONAL FEATURES:

Wet steam curing of concrete assures full strength at shipment—eliminates potentially dangerous "in-service" curing. Black phenolic varnish finish is smooth, flameproof. Metal housings, complete with entrance and exit provisions, minimize stray currents and protect personnel.

For full information, contact your nearest G-E Apparatus Sales Office or write to General Electric Company, Section 422-17, Schenectady 5, New York.



G-E Reactors are Smaller

Progress Is Our Most Important Product

GENERAL ELECTRIC

GET THE WATER... OR THE WATER WILL GET YOU

There's no place for water inside a transformer or circuit breaker shell. Because it's the one place where almost dry isn't dry enough. Insulating oil must be completely dry—nothing less will do.

De Laval Insulating Oil Purifiers can be relied on to thoroughly remove moisture ...they're guaranteed to reduce the moisture content of the oil to 1/1000 of 1%.

That is the major reason why De Laval Guaranteed Performance Purifiers are used by the majority of large power companies.

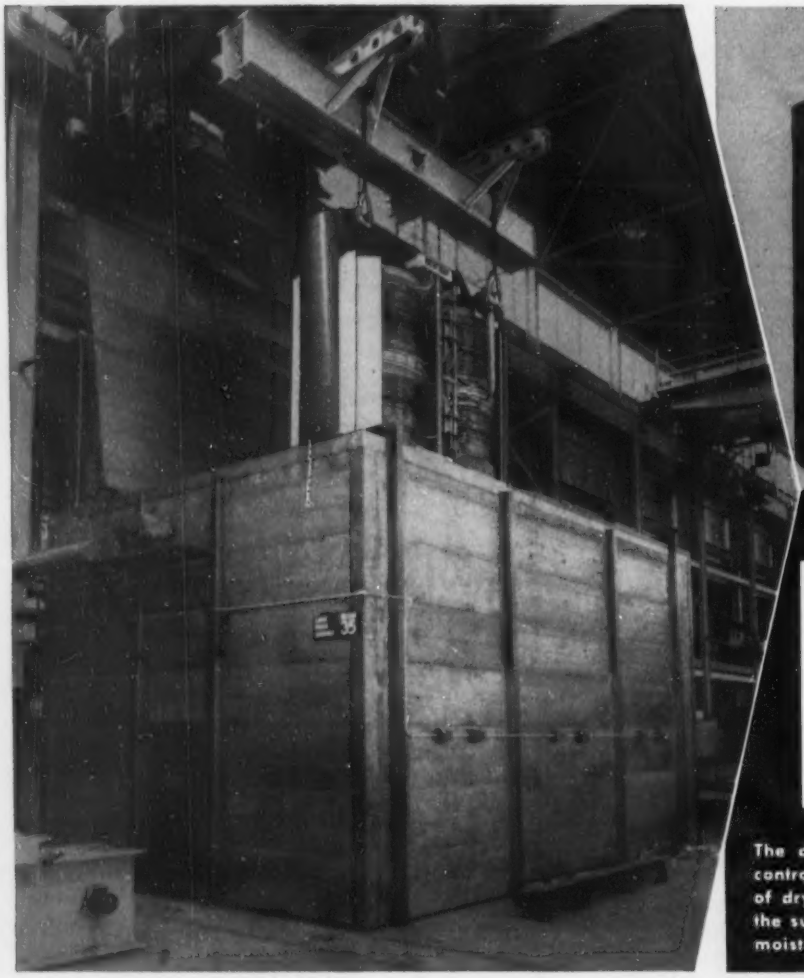
There are other reasons as well. All are given in De Laval Bulletin TR-1. Write for it . . . today!

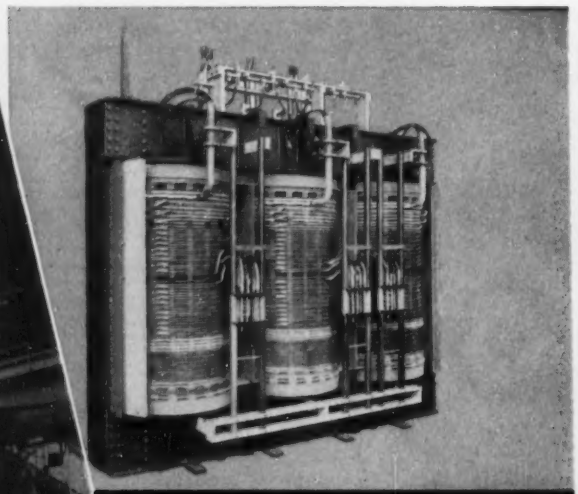
DE LAVAL

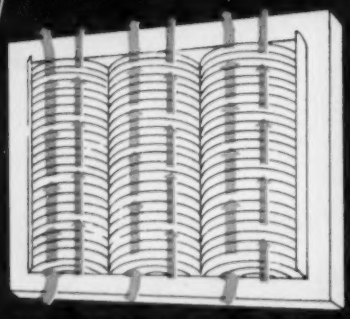
insulating oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 61 Beale St., San Francisco 5

Sahara in







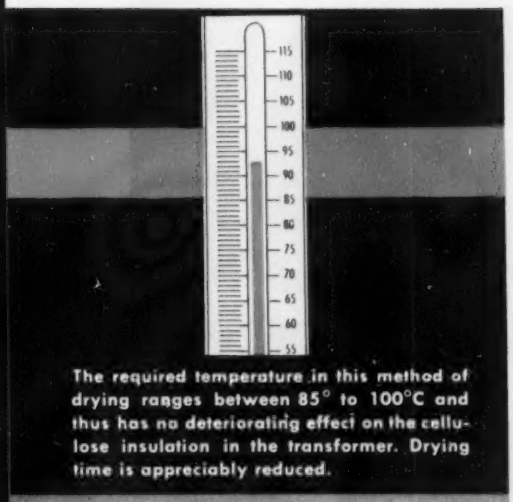
The dew point of circulating air is carefully controlled as compared to conventional methods of drying. At the end of the dehumidification the surrounding air contains only 1/10 grain of moisture per cubic foot.

M O L O N E Y E L E C T

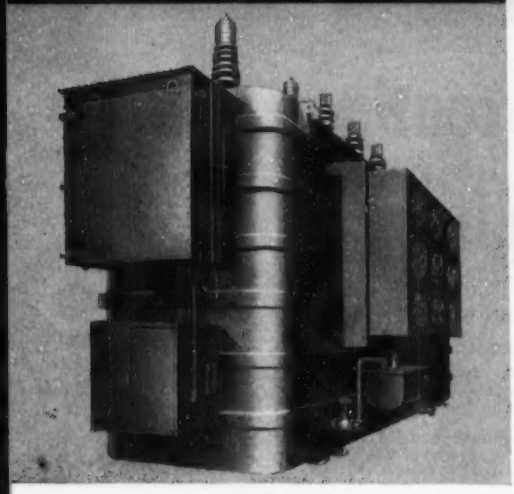
Power Transformers • Distribution Transformers • Step Voltage Regulators
Load Center Transformers • Unit Substations • Network Transformers • Capacitors

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST.

St. Louis . . .



The required temperature in this method of drying ranges between 85° to 100°C and thus has no deteriorating effect on the cellulose insulation in the transformer. Drying time is appreciably reduced.



THE drier your transformers are, the better they will perform; for moisture can affect performance . . . destroy dependability . . . shorten useful life. Moloney Power Transformers are carefully and completely dehydrated in a desert-like atmosphere. They are placed in a modern Monster Dry Air Oven where parched air is circulated at high velocity. All through the careful drying process, temperature and humidity are closely controlled. This permits faster and more effective drying of your equipment without affecting insulation life.

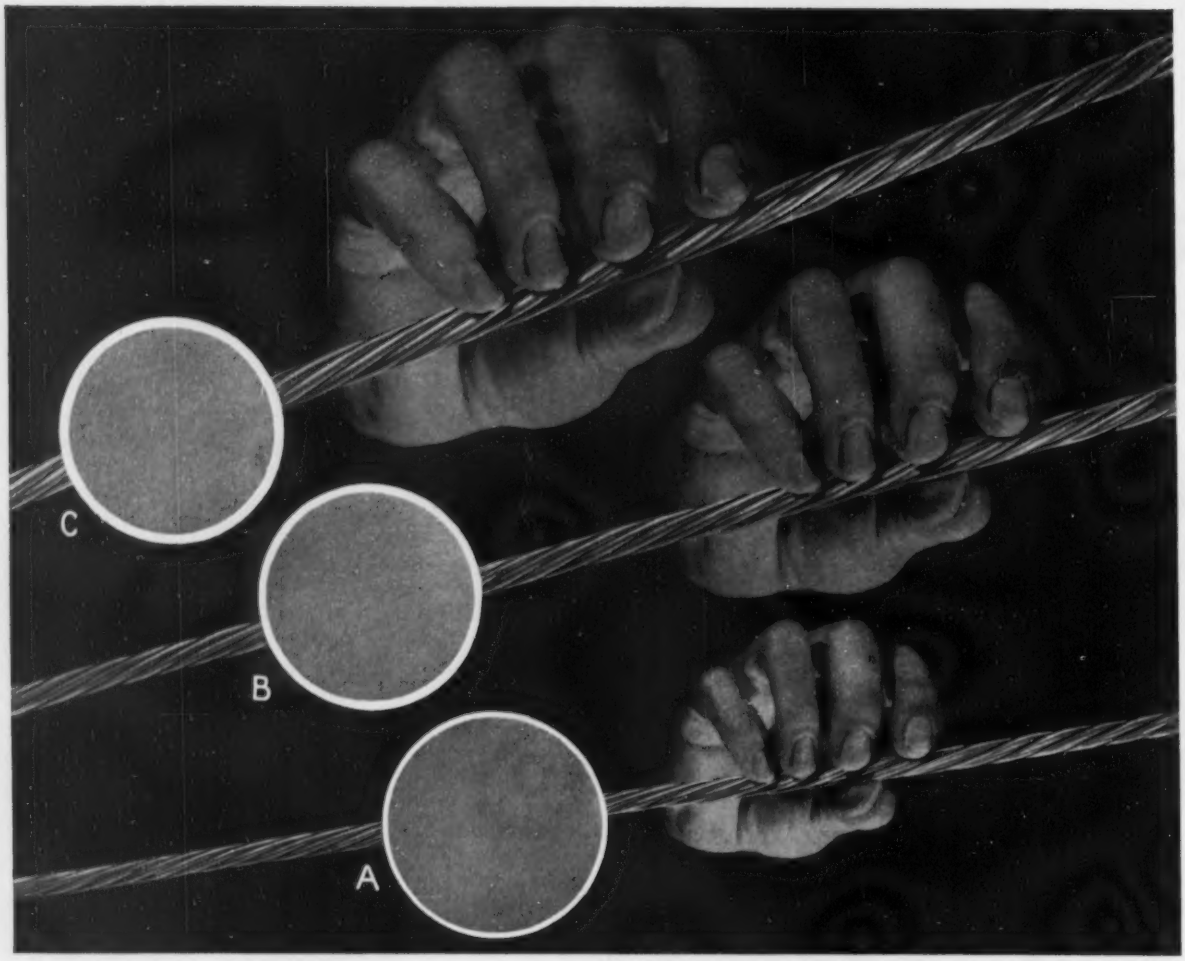
This new drying oven is installed in Moloney's new Large Assembly Bay, containing facilities and equipment necessary to produce power transformers of unlimited ratings to serve your system. For Moloney stands ready today, as it has throughout its 58 years of successful experience, to supply the needs of this nation's utilities.

WEB4 20

R I C C O M P A N Y

Regulating Transformers • Load Tap Changing Transformers
Constant Current Transformers • Transformers for Electronics

LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA



Bethanized Strand has the coating weight you need for any given job

Bethlehem strand with the bethanized coating has an advantage you cannot afford to overlook. It is available not with one, not with two, but with three separate coatings known as A, B, and C. There is no difference in the quality; all are highly-pure zinc, applied by Bethlehem's electrolytic process. But there *is* a difference in the coating *weights,* and that's important.

Coating A, the lightest, is equal to extra-galvanized. Coating B is double the thickness of A; C is three times the thickness of A. All these coatings meet the requirements of the standard ASTM specifications.

Thus, with three weights from which to choose, it is always possible to get the coating you need for any given job. Where line structures and fittings may outlive strand with an A coating, the B coating is more practical. All factors being equal, B will last far longer than A, yet its extra cost is very small.

The third coating (C) is recommended for extreme conditions where even the B might not be adequate. Low in cost from every standpoint, C should be chosen when extra-long life is essential, or when corrosive atmosphere demands a heavyweight coating.

For further details, call the nearest Bethlehem office. Our engineers will be glad to give you the full story.

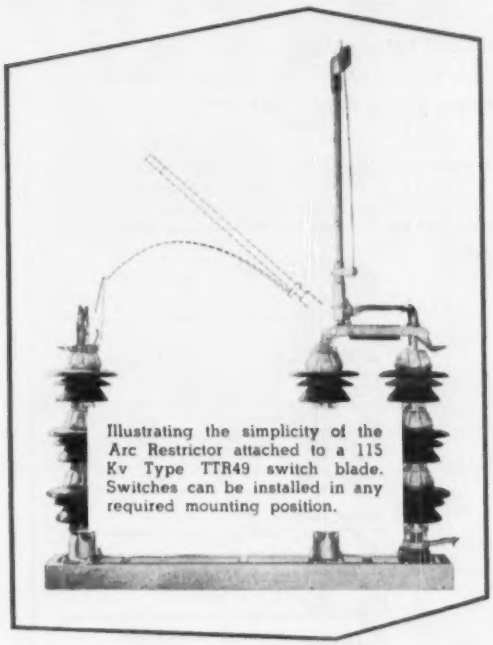
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

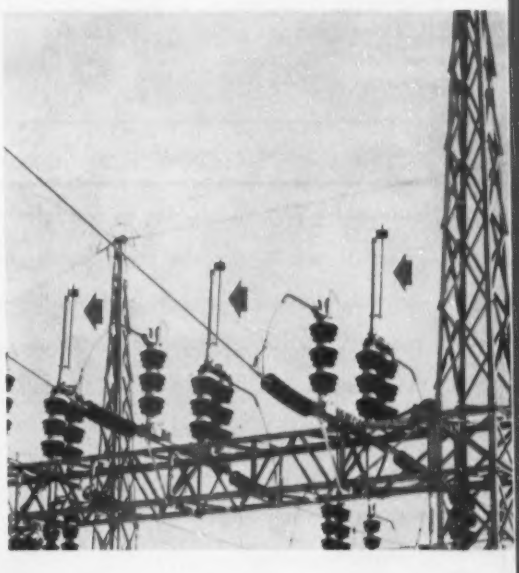
BETHLEHEM STEEL

for switching line charging current —
sooner or later you'll need . . .

R&IE ARC RESTRICTOR SWITCHES



Illustrating the simplicity of the Arc Restrictor attached to a 115 Kv Type TTR49 switch blade. Switches can be installed in any required mounting position.



1. **COMPLETE ASSEMBLY PACKAGE—switches with horns**

2. **ATTACHMENTS—for already installed switches.**

either way you get them, they can

COST YOU LESS

1. FURNISHED WITH SWITCHES, you can . . .
   - Increase usefulness of air switches many times.
   - Decrease Horn Gap Switch phase spacing. SAVES STRUCTURE COSTS!

2. SUPPLIED FOR ALREADY INSTALLED SWITCHES, you can . . .
   - Switch Line Charging Current and Transformer Magnetizing Current with your standard R&IE Disconnecting Switches. SAVES ON MORE COSTLY INTERRUPTING DEVICES!

THE Arc Restrictor has been tested for ice conditions and interrupting ability in the laboratory and in the field. Consult your R&IE Division representative about available test data and demonstration films.

R & I E SWITCHING EQUIPMENT
DIVISION OF I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

STRUCTURES—steel • aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION

How Well Does Your Present Source Compare With National's COMPLETE Facilities For Motor and Generator Repair

Most motor repair shops can perform some of the operations listed below. Very few can handle them all. These are not routine operations, but extras which require expensive specialized equipment and experience. National service includes all 17 operations. How does your present repair source compare?

plus value operation	*available at National*	*at your present repair source*
1. redesigning and modernizing by competent engineers	yes	
2. vapor degreasing to insure good bonding of varnish	yes	
3. corncob blasting to prepare surfaces like new	yes	
4. rebuilding and remachining to standard of mechanical fits	yes	
5. temporary hotbanding to seat coils in slots	yes	
6. hot rerolling of permanent bands	yes	
7. grinding and polishing of journal shafts	yes	
8. vacuum impregnating	yes	
9. dynamic balancing	yes	
10. grinding and polishing of commutator at top operating speed	yes	
11. load testing	yes	
12. high frequency testing	yes	
13. electronic bar-to-bar and high sensitivity ductor testing	yes	
14. surge comparison testing	yes	
15. high potential ground testing	yes	
16. magniflux testing	yes	
17. anti-friction bearing inspection	yes	
Total	17	

If you can't answer "yes" for your present source on all 17 operations, you're taking unnecessary chances on getting less than the best repair work. You can't tell in advance on which jobs National equipment and National know-how will pay off in improved performance or longer life. So play it the one safe way — make National your first source for *all* motor and generator repairs.

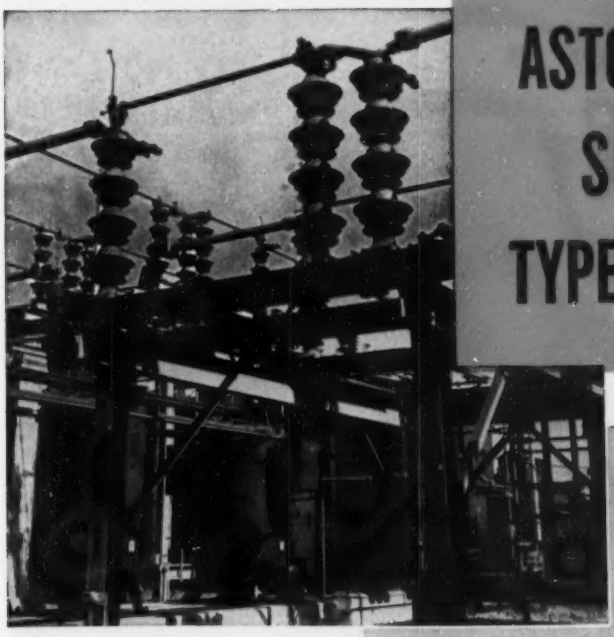
For more details on why the motor or generator you send to National will often come back better than new, call your nearby National field engineer today. Or drop us a line for his name and address.

NATIONAL ELECTRIC COIL COMPANY

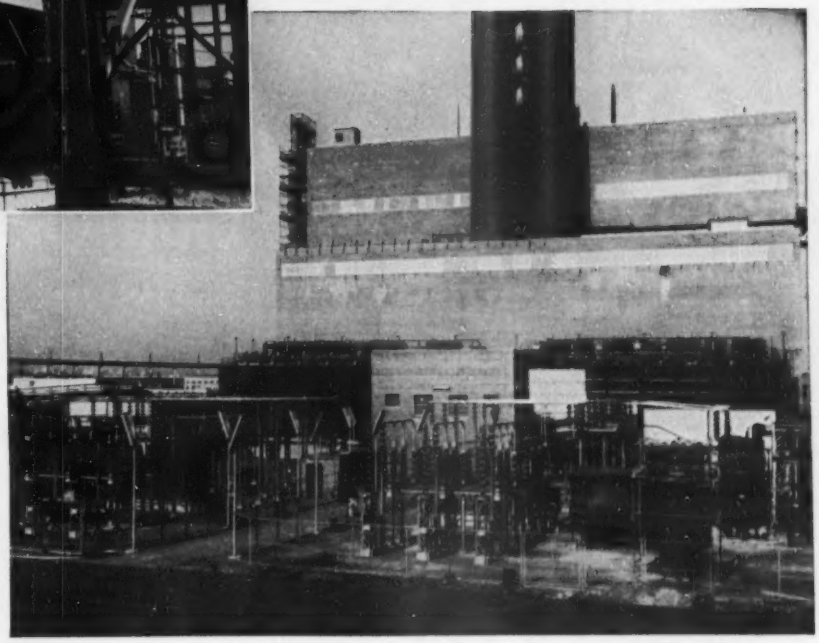
COLUMBUS 16, OHIO, U. S. A. TRADE MARK

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

ASTORIA STATION USES SOUTHERN STATES TYPE WAG SWITCHES



In use at the Astoria Station are Southern States 161 kv, 1200 ampere Type WAG Air Break and G-WAG Grounding Switches, shown here. The Type G-WAG is mounted integrally with the Type WAG on either the jaw or hinge-end stationary insulator stack. Mechanical or electrical interlocks (or both) are supplied to prevent air switch and grounding switch from being closed at the same time.



A section of the Astoria Generating Station of the Consolidated Edison Co. of New York, Inc. The station when ultimately completed, will have a capacity of over a million kilowatts. The newest type of equipment is used in this latest addition to one of the nation's largest electric utilities.

Consolidated Edison Company's new Astoria Station, the last word in steam generating plants, naturally uses equipment that assures maximum protection against mechanical or electrical failure. Dependable service to its 2,800,000 meters has long been a must for one of the Nation's largest electric utilities. No chance can be taken with this vital load. So it was only natural that Southern States Type WAG Air Break and Grounding Switches were chosen for the Astoria Station.

The superior features of Type WAG Switches, in voltage rating from 7.5 to 230 kv and current ratings from 400 to 4,000 amperes, are fully described in our Bulletin No. 390-R. A copy of it is yours on request. Read it and find out why it will pay you to always specify Southern States Switches.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

ANHYDREX STOPS CHANCE
IN UNDERGROUND CABLE BUYING

Cable that is to be buried directly in the ground should be bought for one reason. That reason is to do the job. If cable is bought for price, for friendship sake, or for any other reason, it is a gamble. There is no place for luck in underground cable purchase.

The cable being buried in this picture is jacketed with neoprene and insulated with Anhydrex. It will get soaked every time it rains or snows. But it won't fail, as so many cables do, from water absorption. Why? Because no cable insulated with Anhydrex has ever failed from water absorption.

Anhydrex-insulated cables withstand wet weather and waterlogged ducts for long periods of time. That means exceptionally long life because of exceptionally stable electrical and physical properties possessed by Anhydrex. The specially-compounded neoprene jackets are resistant to oil, sunlight, flame, acids, and alkalies.

For these reasons, Simplex-ANHYDREX insulated cables, Type USE, are ideal for direct burial in the ground. The only protection needed is a thin bed of sand, and a board laid over the cables so that rocks and sharp instruments will not damage them. Catalog 1013 has more details. Write for it today.

Simplex–ANHYDREX
Insulated TYPE "USE"

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

Pioneering New Horizons
our specialty . . .

FROM THE FIRST MOMENT Pioneer is retained to help you plan your new electric power station, Pioneer becomes a part of your company, thinking and planning in your best interests . . . Pioneer has 52 years of experience to aid in determining the necessary plant capacity and its construction cost, to select the site and design the generating station . . . Pioneer will also design any needed service or office buildings and act as your agent in purchasing construction supplies and materials . . . Pioneer offers complete valuation, depreciation and rate services . . . .it will supply stock transfer and dividend distribution services . . . Our consulting staff provides experienced advice on company management, corporate finance, accounting and taxation matters . . . a well-rounded schedule to relieve your overload periods.

For complete information on Pioneer's services, write for our factual booklet, "Pioneering New Horizons", yours for the asking.

Pioneer Service & Engineering Co.
231 South La Salle Street · Chicago 4, Illinois

52 YEARS

it's time for a new meter...

when Mrs. Riley...

gets her electric range

Since the day she took up the role of homemaker, Edith Riley has had a gas stove, of one kind or another, in her kitchen. But times have changed, and, well . . . the Rileys are getting an electric range this time.

The Rileys, and the thousands of American families like them who are turning to electricity to do more and more things, are going to need high capacity meters.

There is a new extended range meter on the market that will easily handle the heavier loads created by the rapidly increasing use of electricity. It's the Sangamo J2, a 15 ampere meter with straight-line accuracy up to 100 amperes. As a matter of fact, the J2 has the capacity to carry 100 amperes *continuously* without overheating, yet it has sufficient torque to accurately measure even the lightest load.

When you invest money in meters you know are going to have to handle greater and greater loads, protect your investment by choosing a meter with plenty of reserve ability to measure the growing use of electricity.

Choose the new Sangamo J2—the first . . . and finest . . . 15 ampere meter with 100 ampere capacity.

A METER WITH STRAIGHT LINE ACCURACY

UP TO 100 AMPERES

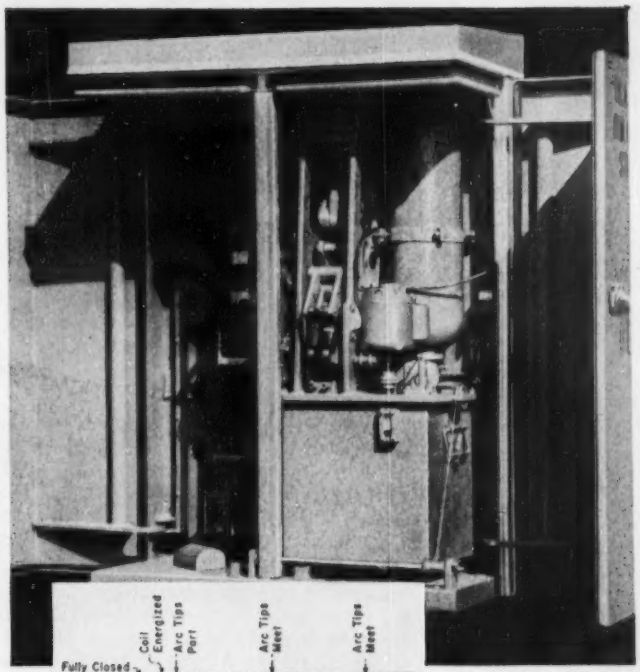
SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

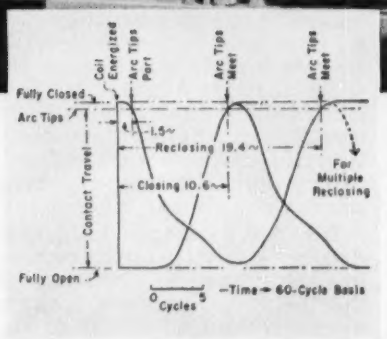
JM54-7

Complete Hydraulic Closing for Circuit Breakers

PACIFIC ELECTRIC
Type OA
HYDRAULIC OPERATOR
(Compressed-Gas Accumulator Type)

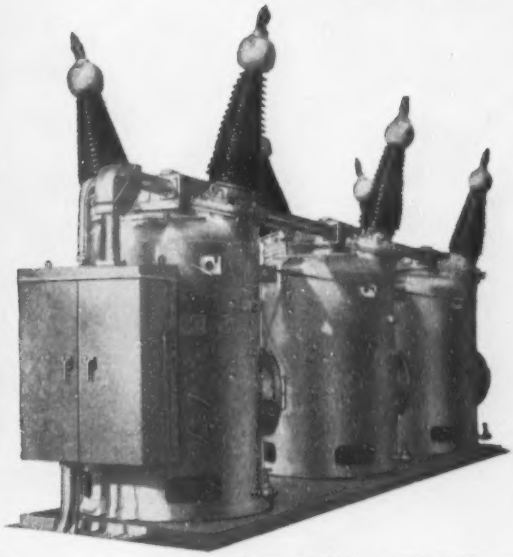
- **Compact**
- **Low Inertia**
- **Rapid Response**
- **Smooth Operation Without Impact**
- **Electrically and Mechanically Trip Free**
- **Low Maintenance**





Above: Type OA Operator in Cabinet with doors open. Shows accumulator and sump tank that contains all hydraulic components.

At left: Typical Time-Travel Curve—taken with oil in tanks. Shows 20-cycle reclosing (for shorter time refer to factory). Five immediate reclosures obtainable, if required, all at same speed.



Above: This 115-kv, 3-cycle, 5000-mva Pacific Electric circuit breaker with Type OA hydraulic operator in use on a leading power system.

SIX YEARS AGO Pacific Electric introduced hydraulic energy transfer as a part of circuit breaker closing. Hundreds of these semi-hydraulic operators (the Type MO-5) are used by leading power systems, from 115 kv thru 230 kv. These operators also embody hydraulic interlocking and hydraulic control of deceleration (which Pacific pioneered years previously). They represent an important part of Pacific Electric's line.

Also six years ago, Pacific Electric started development of a *fully* hydraulic operator because the upward trend of ratings made it desirable to have more powerful operators of smaller physical size.

These new fully hydraulic operators (the Type OA-4) are in production; deliveries to several power systems have been made. Their use in system protective service dates from Sept. 1953.

The new operator has the advantages outlined at the top of this page. A feature is a direct-connected piston-cylinder unit that closes the breaker and that also is the means for decelerating hydraulically both the opening and closing strokes. Hydraulics are also utilized for other purposes—wherever rapid response without impact is a requirement.

For further information, ask for Catalog 587.

Since 1906

SALES OFFICES or AGENCIES in PRINCIPAL CITIES

PACIFIC ELECTRIC SWITCHGEAR DIVISION

FEDERAL PACIFIC ELECTRIC CO.

5815 THIRD STREET • SAN FRANCISCO 24 • CALIFORNIA

Allis-Chalmers

NETWORK Meets Growing Load

UNION ELECTRIC COMPANY faced both load and space problems in downtown St. Louis. Increasing loads required an addition to the company's network system. Heavy congestion made space hard to find.

So when space was located, the company planned wisely for future growth as well as for the present problem. The new vault was made double size. Holding a 500-kva Allis-Chalmers network transformer now, it leaves room for one more when future growth demands.

Careful attention to details during design and construction makes A-C transformers especially suited for this type of installation. Accessories are conveniently located. Protective coating against corrosion is applied to surfaces and tubes in the base area. Best possible sealing for bushings is provided by spiral wound metallic gaskets.

It will pay you to investigate all these details — as well as the compact low-loss design and high thermal capacity that help A-C network transformers meet severest load conditions. Get more facts from your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4186

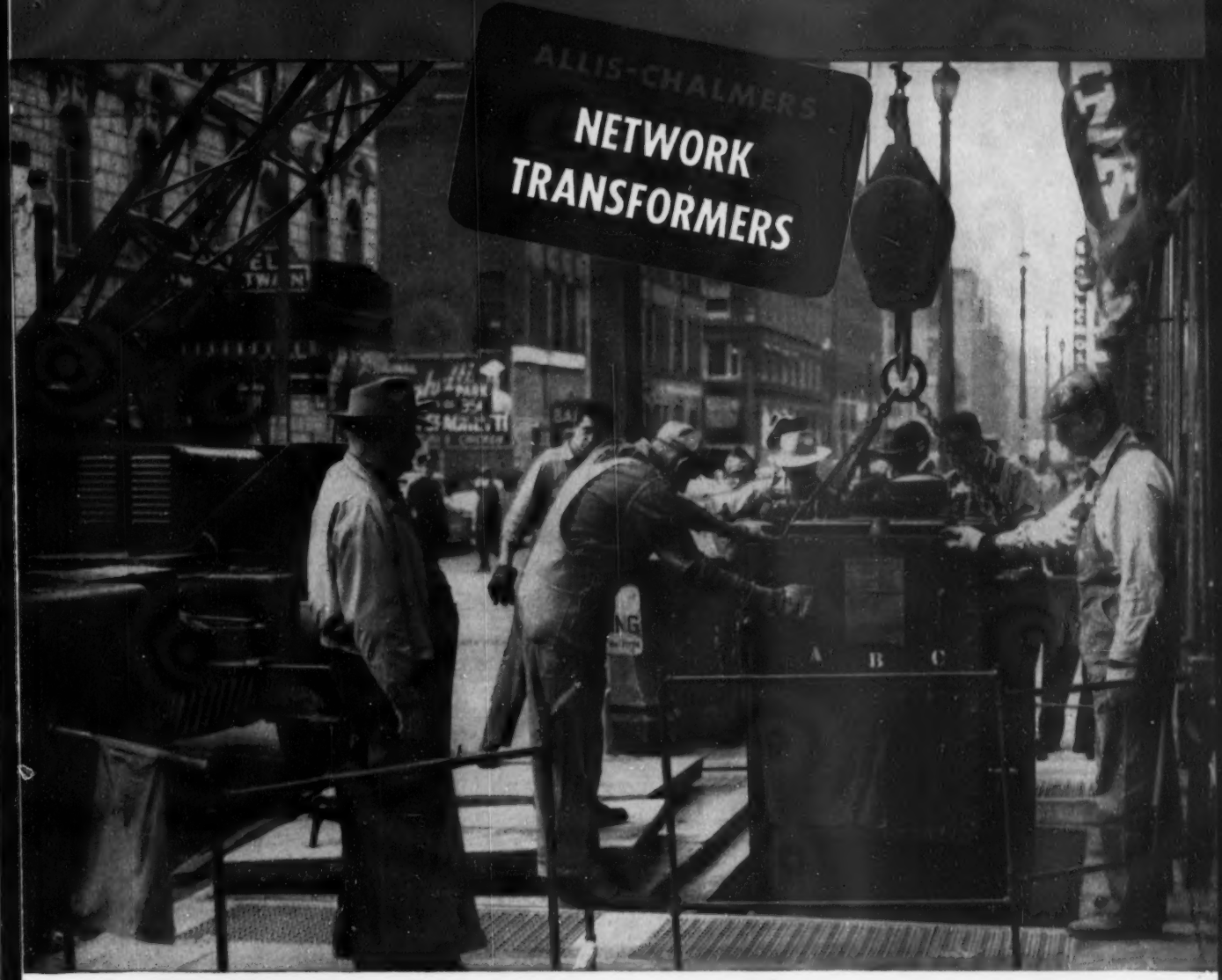
UNION ELECTRIC'S installation foreman, J. Edward Slocksick, checks nameplate information before new network transformer is installed near corner of Eighth and Pine Streets in the heart of St. Louis.

AREA SERVED includes one of the largest office buildings in St. Louis, the Arcade Building, where St. Louis Cardinals and many other amusement enterprises maintain offices. Building also contains many popular commercial shops. Left: crane picks transformer off truck.

ALLIS-

TRANSFORMER

in Downtown St. Louis



NETWORK TRANSFORMER was lowered into an entirely new vault, constructed double size to leave room for future system growth. Allis-Chalmers network transformers have been serving Union Electric for ten years. More than 1¼ million kva of these units are in operation throughout the country. Dependability — proved by outstanding service records — shows why Allis-Chalmers network transformers are ideally suited to crowded locations like this where service continuity is all-important.

CHALMERS

A-C ALLIS-CHALMERS

FORECAST: Electrical Utilities to Increase

Phelps Dodge will help you meet your Expanding Power Cable Needs!

PRACTICAL EXPERIENCE IN RESEARCH, COMPLETE RANGE OF HIGH

THE electric utility industry will increase its generating capacity by 13 million KW in 1954.* Phelps Dodge is meeting this constant high-voltage power cable expansion program with research, design, and manufacturing know-how. Year after year, Phelps Dodge has met utility demands for cables with higher voltage ratings and greater carrying capacities. Phelps Dodge's experience, research facilities and engineering skill are the answer to your cable requirements regardless of voltage or type.

**Electrical World*

PHELPS DODGE COPPER PRODUCTS CORPORATION

Generating Capacity 13 Million KW in 1954

DESIGN AND MANUFACTURE OF A VOLTAGE POWER CABLES!

69 KV...to...230 KV

Typical examples of Phelps Dodge power cables engineered to meet modern utility power requirements. On the left: self-contained, three-conductor, medium pressure, gas, 69 KV cable. On the right: the highest voltage cable to be installed in the United States, a pipe-type, three-conductor, oil compression, 230 KV cable.

HOLAN POWER

AND ASSOCIATED

CHECK LIST

SERIES 3700 HEAVY-DUTY LIVE-BOOM DERRICK

*12,000 Pounds rated capacity • three-legged • *full capacity live-boom • no obstructions at rear of body • *automatic throttle control • positive fully enclosed link drive • all cylinders double acting • check valves and resistors among the many safety features • insulated controls—extend away from body for additional safety . . .

CHECK LIST

SERIES 4700 LIGHT DUTY DERRICK (Front or Rear Mounting)

6500 Pounds capacity • two-legged • limited live boom action • rear opening of body obstructed by side legs • limited rear platform loading • excessive body reinforcement not required • low initial cost • be sure to check effective lever arms in the 4700 Derrick

3700 DERRICK handles 70-foot poles with ease. *Variations are now available to handle up to 100-foot poles and "H" frames.

*195 DEGREE WORKING RANGE of 3700 Derrick Model "HL" to 5-foot ground height permits easy threading of winch cable through derrick head.

*STIFF-LEG INTEGRAL removes pole from toughest ground.

*SELF-STOWING HYDRAULIC JACKS (Patents applied for) (Optional) Self positioning in matter of seconds—will level rear of body—raise rear wheels—eliminates crawling under truck—no pins—lever controlled simplicity promotes use by linemen.

DERRICKS

POWER EQUIPMENT

. . . designed for any operating condition

. . . priced for any budget

OUTSTANDING

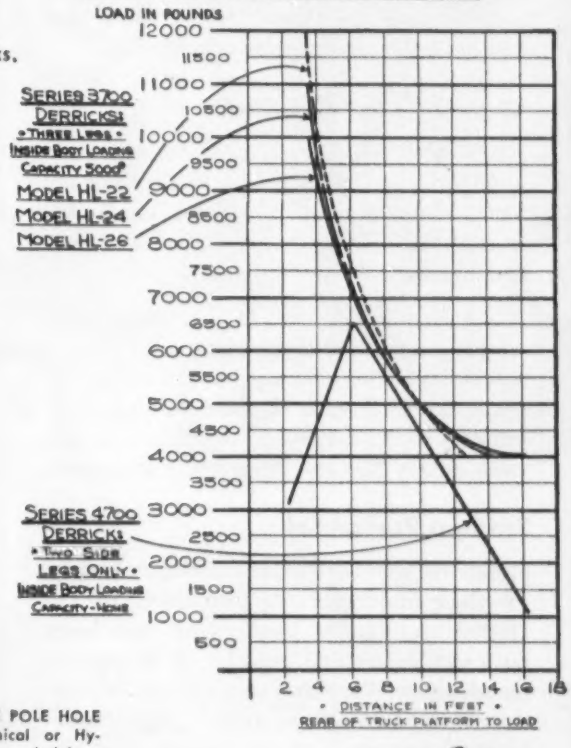
and untiring research and development has made it possible for the Holan Corporation to offer you these new labor saving devices. If your check list for power derricks is based on CAPACITY, OPERATING FEATURES, DESIGNS, BODY LOADING FEATURES, EFFECT OF LOADING ON BODY PROPER, OPTIONAL EQUIPMENT FOR GREATER VERSATILITY, SAFETY . . . then PRICE, your first choice will be these New Holan 3700 and/or 4700 Derricks.

- For the maximum in power and performance, the 3700 Heavy Duty Live-boom Derricks have no equivalent.
- For a front or rear mounted light duty derrick the 4700 will compete with the best of them.
- For optional equipment, such as, self-stowing hydraulic jacks, portable pole hole diggers (mechanical or hydraulic drive), designed to cut operating cost, check Holan.

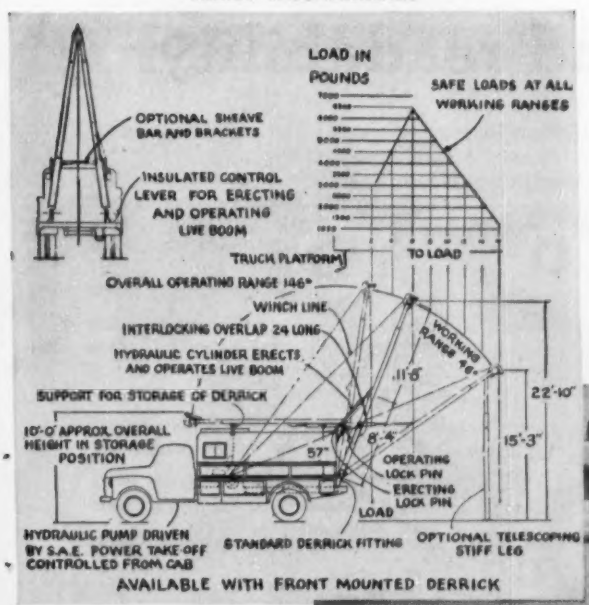
Others eventually will duplicate these advantages in capacity, design and optional features. But, you can reach a new low in installation, service and maintenance costs *today* with these new improved Holan derricks—typical of the new complete line of HOLAN LABOR-SAVING EQUIPMENT.

PERFORMANCE CHART

SAFE LOADS AT ALL WORKING RANGES



SERIES 4700 DERRICK



*NEW PORTABLE POLE HOLE DIGGER (Mechanical or Hydraulic Drive) Suspended from derrick — compact — many new safety features—another "first" in many ways!

*Another HOLAN "First"

J.H. HOLAN CORPORATION

4100 West 150th Street
Cleveland 11, Ohio

District Sales Representatives
6-03 161st Street, Beachhurst, Queens, New York
2754 N. 92nd Street, Milwaukee 10, Wisconsin
8802 Vicksburg Street, New Orleans, Louisiana

Hydraulic Derricks • Jacks
Ladders • Towers • Diggers
and Accessories for
Truck Bodies

When you need instrument service . . .

Ever have a tire blow out while you're traveling late at night? If it happens near a service station, you're lucky. But if it's on a lonely road far from town, you've got trouble.

When it comes to service on instruments, you don't need to take chances on being lucky. Because when you have Honeywell instruments, you've always got the comfortable feeling that service is close at hand . . . whenever and wherever you want it . . . from the world's biggest instrument service organization.

Over 110 Service Centers

No matter where you may be, there's a Honeywell service man near you. Offices are located in more than 110 cities of the United States and Canada, near every large production center.

When you run into trouble, just telephone or wire the nearest of these offices. You'll get a service specialist promptly . . . often within a few hours. This quick attention to your needs protects your production schedules, and prevents delays that can cause costly stoppages.

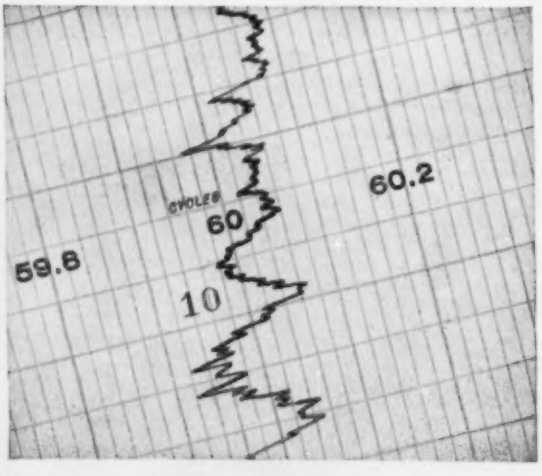
Trained Personnel

Honeywell service men are thoroughly trained for their important responsibilities. In the Honeywell factories, hand-picked men learn both the theory and practice of instrument maintenance. Then they serve an apprenticeship in the field offices, to gain further first-hand experience. You can be sure that the Honeywell man who calls at your plant is a qualified specialist, well versed in the practical art of keeping good instruments in the best condition.

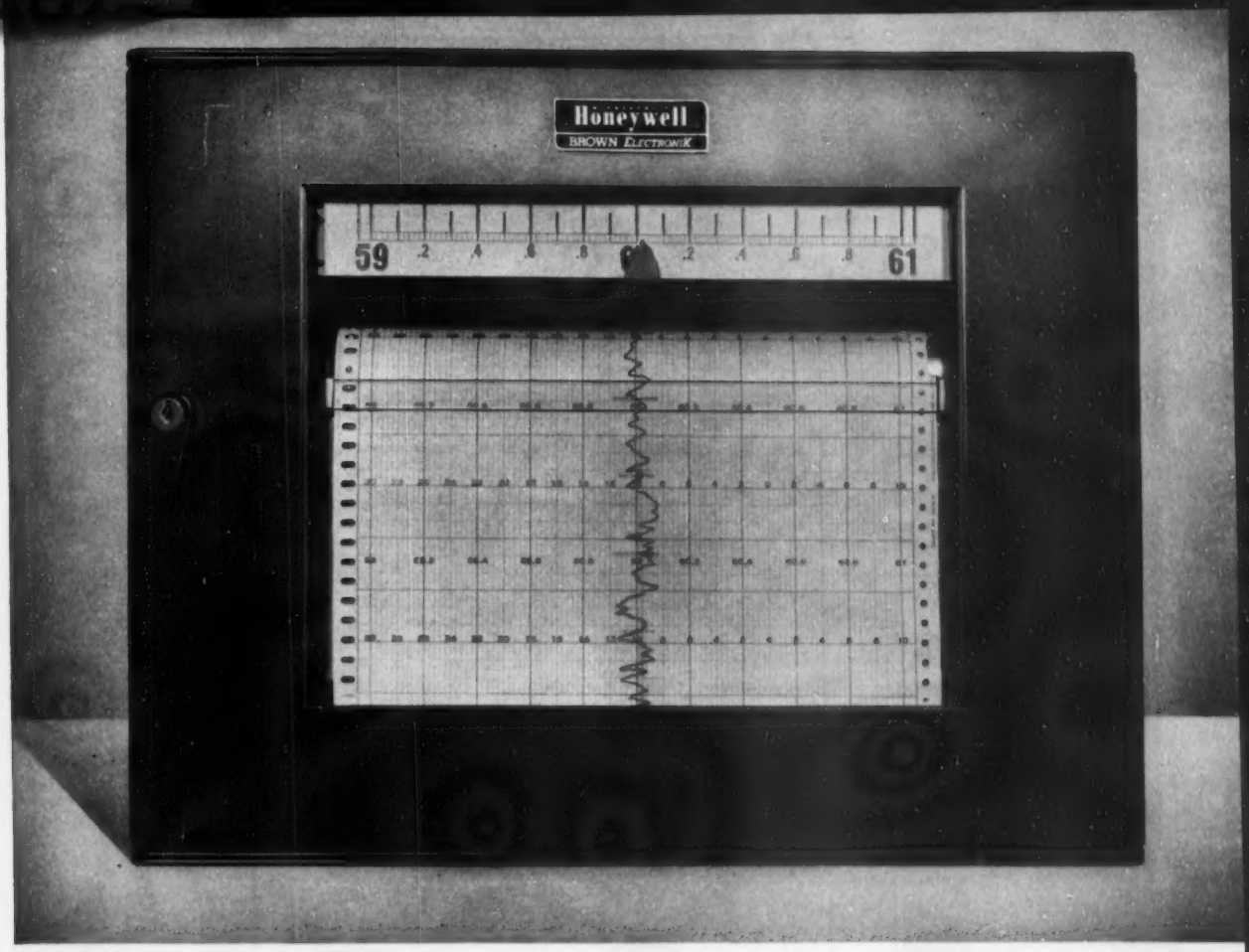
Periodic Service

But why wait for emergencies—when you can prevent them with periodic service. Under a simple contract, a Honeywell man will visit your plant at regular intervals to inspect, clean and adjust your instruments and controls. The plan is economical, and can save you hours of production time. Our nearby branch office will be glad to give full details on Honeywell Periodic Service.

New *ElectroniK* recorder brings greater precision and readability



Full size section of chart shows the detail of record obtained with the new high precision, high sensitivity ***ElectroniK*** *frequency recorder.*



to frequency measurements

BY MEANS of the new *ElectroniK* frequency recorder, load dispatchers can now have a clearer, more accurate picture of system frequency as a guide to regulating generation and interchange. A new pulse-type measuring circuit . . . in conjunction with electronic "Continuous Balance" measurement . . . brings greater precision and speed than ever before to frequency recording.

Better readability is made possible by this highly sensitive instrument. The range from 59 to 61 cycles, for example, is spread across 11½ inches of calibrated chart and scale.

Unaffected by wave form and temperature—inaccuracies of earlier bridge-type circuits are eliminated.

Rapid response—electronic balancing circuit keeps in step with quick changes in frequency that mechanical instruments cannot follow. Pen speeds of 12 and 24 seconds full scale are available.

High precision—new circuit has more than double the accuracy of previous types. Overall accuracy is ±0.01 cps.

A choice of ranges for both 60 and 50-cycle systems is available. The new instrument is readily adaptable to automatic load and frequency control systems, operating in conjunction with existing electronic or mechanical instruments.

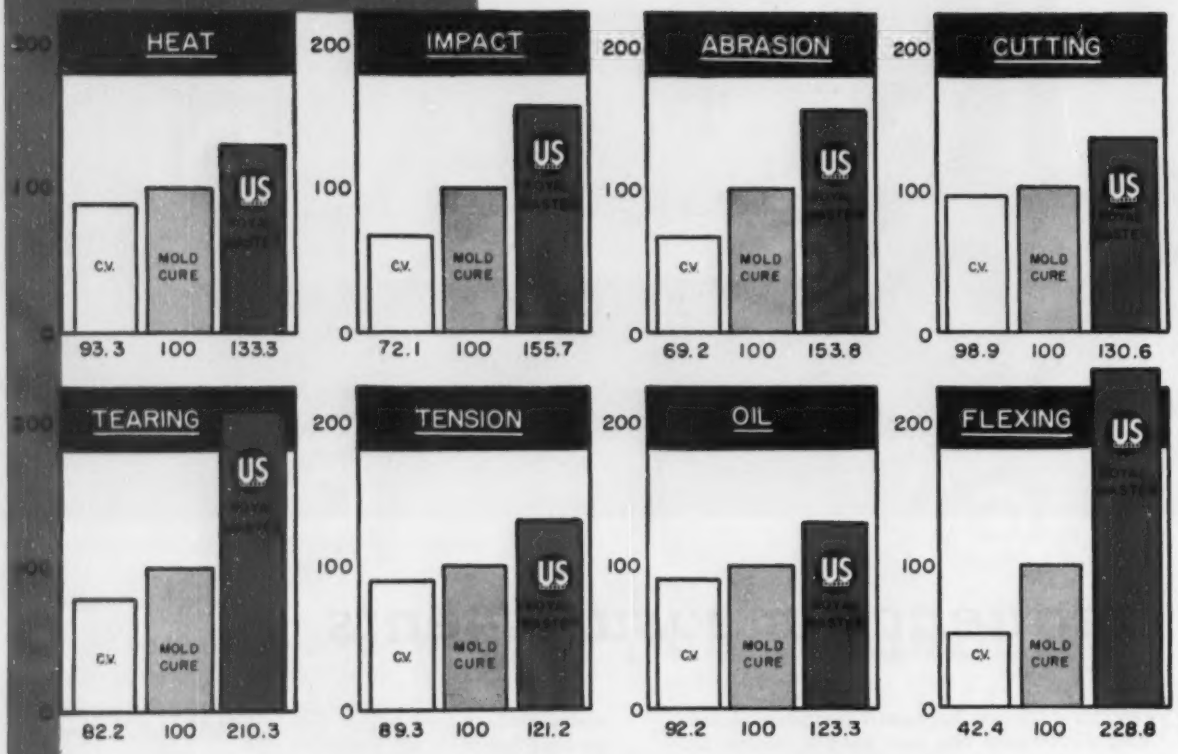
Your nearby Honeywell sales engineer will be glad to discuss applications to your own power system. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Data Sheet No. 9.1-8a, "*ElectroniK* Frequency Recorder."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

New U.S. ROYAL outperforms,



Comparative performance of portable cords related to major life factors.

Graphs illustrate the outstanding superiority of new U. S. Royal Master Cord—over the average of molded cords and the average of short-lived continuous vulcanized cords of other makes—on every major life factor. (Average of other molded cords is rated at 100%.)

US RUBBER

UNITED STATES

ELECTRICAL WIRE AND CABLE DEPARTMENT

MASTER portable cord *outlasts all others!*

Comparative tests show U. S. Royal Master gives $1.88 in value for every $1.00 spent — almost *twice* the service value of the average of other molded cords!

Two years ago, "U. S." engineers began a *complete reexamination* of portable cord construction, service life, and the causes of cord failure.

Over 10,000 tests were made. More than a thousand cords of all leading makes, including our own famous U. S. Royal Cord, were analyzed, tested, and compared.

Every life factor was considered and carefully evaluated, alone and in its relation to overall cord performance and service life.

Backed by 64 years of experience in the manufacture of electrical wire and cable, U. S. Rubber engineers then translated their findings into an entirely new portable cord, designed to surpass any other previously made.

Extensive tests, both in the laboratory and in outside plant installations have proved this new portable cord startlingly superior in every respect!

New U. S. Royal Master is unquestionably the finest cord you can buy!

From every standpoint, as the charts at left illustrate, new U. S. Royal Master is a finer, more durable cord—actually gives 88% longer life than the average of competitive molded cords—far longer than *any* other cord—surpassing even a hypothetical cord incorporating the best features of all those tested!

Far greater value, too! In spite of almost doubled service life, this great new cord is in the same price category as other molded cords—giving you $1.88 in cord value for every cord $1.00!

Prove to yourself the outstanding superiority of new U. S. Royal Master Portable Cord — in both service life *and* economy! Get in touch with your "U. S." distributor today!

Approved by Underwriters' Laboratories, Inc.

RUBBER COMPANY

ROCKEFELLER CENTER, NEW YORK 20, N. Y.

THE FISHER-PIERCE
SERIES 64400 PHOTOELECTRIC CONTROL

This control embodies the proven, dependable F-P basic circuit, in a simple, compact form. Mounting versatility of this unitized control is represented in the adaptions to various manufacturers' luminaires illustrated here, as well as ballast, pole top, cross arm, standard and other mountings.

Versatility of the Series 64400 Control is equalled by its economy. Low initial cost, savings in wiring, labor and materials, as well as low maintenance cost, make it economically practical to use one F-P 64400 Control per lamp.

Complete Descriptive Data on Request

THE FISHER-PIERCE CO.,
82 Pearl Street, So. Braintree, Boston 85, Mass.

EXPORT: PHILLIPS EXPORT CORP.
DIVISION OF NORTH AMERICAN PHILLIPS
100 E. 42ND STREET
NEW YORK 17, N. Y.

IN CANADA:
NORTHERN ELECTRIC
CO., Ltd.

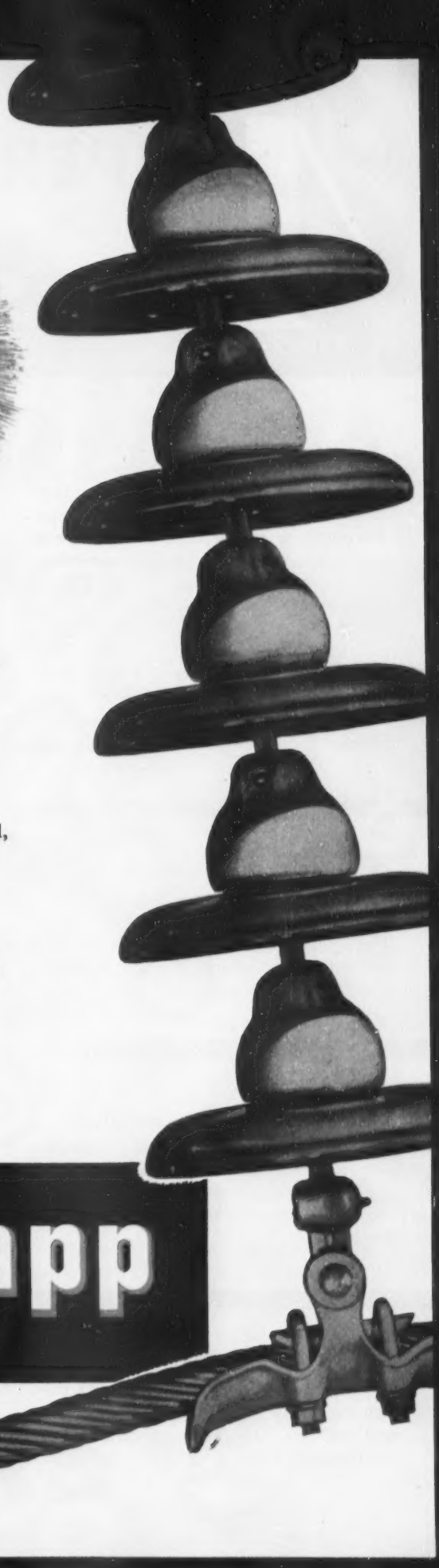
ANY SUSPENSION INSULATOR WOULD BE GOOD ENOUGH if

The "standard specification" for suspension insulators undoubtedly provides for all characteristics necessary to insulate your transmission lines. You are safe to buy any insulators under such a specification . . . *IF* . . . *IF* a sufficiently thorough testing program authenticates the fact that the insulators you buy *do* meet the specifications. And *IF* you have evidence that they will still meet the specifications after years of service.

Lapp knows that those are big *IF's*. So big, in fact, that it's not at all safe to assume that "all suspension insulators are alike." Lapp could not be producing the quality of insulators it ships today without a continuing research and development program in insulator design, raw material control, production methods, glaze fit, sanding and cementing techniques —and a never-interrupted program of severe electrical and mechanical testing.

If you want lines which will stay in trouble-free service over the years . . . we suggest you look beyond the "standard specification." When you've found the real differences in suspension insulators, you'll find, as so many companies have, that there's a positive extra margin of operating safety and security . . . long life . . . and low upkeep . . . on lines built on Lapp insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.



4 OPERATION-PROVED OF *Super*

1 Save on Plant Costs. A steam turbine generator unit with supercharged cooling produces significant savings both in area of plant and in foundation design. For example, in total plant space a 150-mw unit will require 20 feet less because rotor-removal distance is shorter than that of conventionally cooled units. In foundation length at least 10 feet can be saved, and foundation loading is reduced because stator weight is only a fraction of that for conventional cooling. The corresponding reduction in crane span and lifting capacity affords further savings.

2 Save Switchgear Costs. Savings are possible because of higher reactances and consequently lower fault currents. The 2-pole fully supercharged machine has reactances almost identical to those of a large 4-pole generator.

3 Reduce Conductor Expansion . . . because the axial length of the generator is much less than that of a conventionally cooled machine. In addition, the average and differential temperatures are lower.

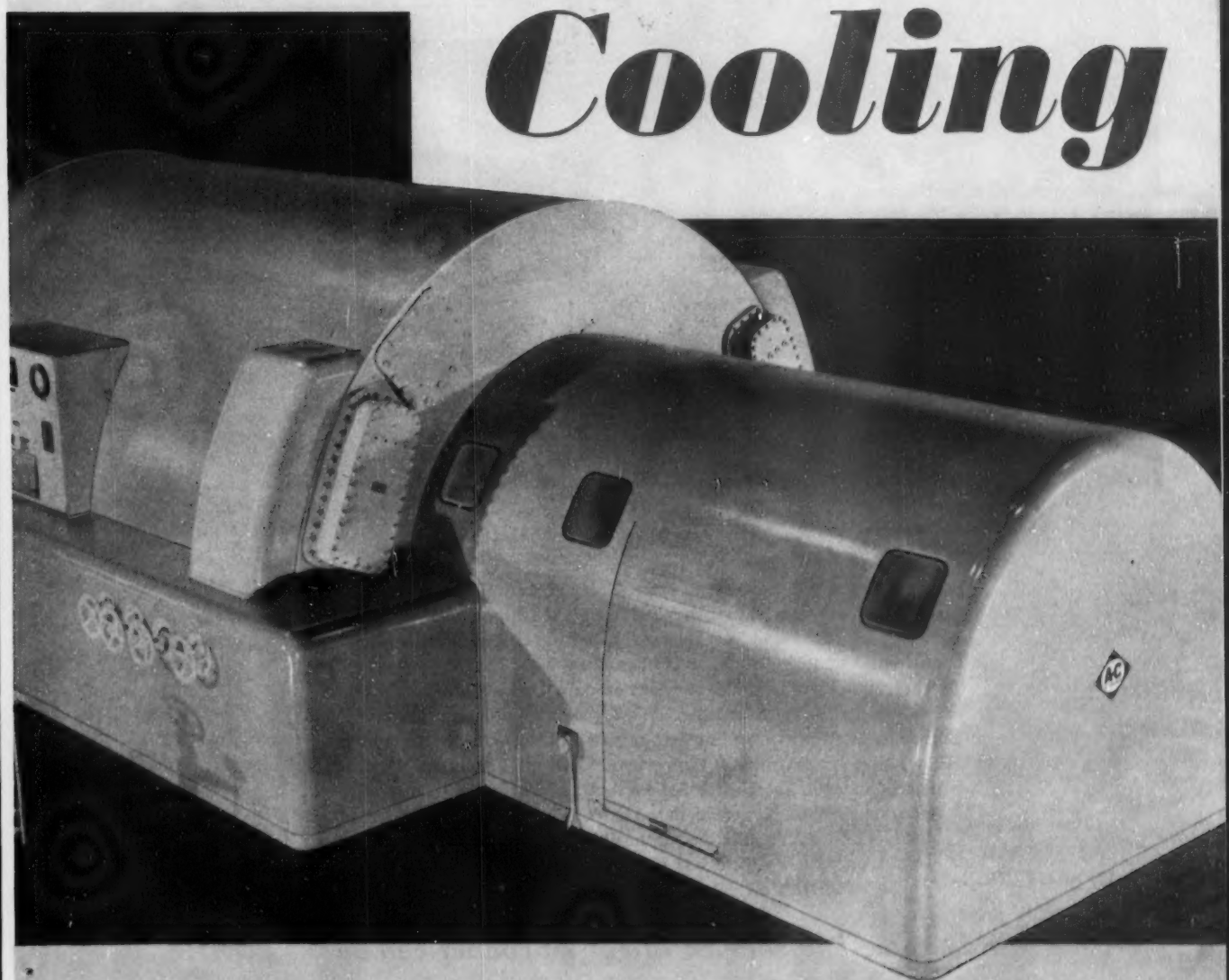
4 Simplified Installation and Inspection. Light weight and compact design facilitate handling, reduce bearing and seal size. Oil and gas requirements are minimized.

For units of present-day capacities, like the steam turbine generator unit shown above, supercharged cooling has proved a means for providing important economies. In addition, operation of these units since 1951 shows that

LIGHT FOR FREEDOM · LIGHT'S DIAMOND JUBILEE · 1879 1954 · POWER FOR PROGRESS

ALLIS-

ADVANTAGES *charged Cooling*



this Allis-Chalmers pioneered development lifts the lid off future increases to higher capacities.

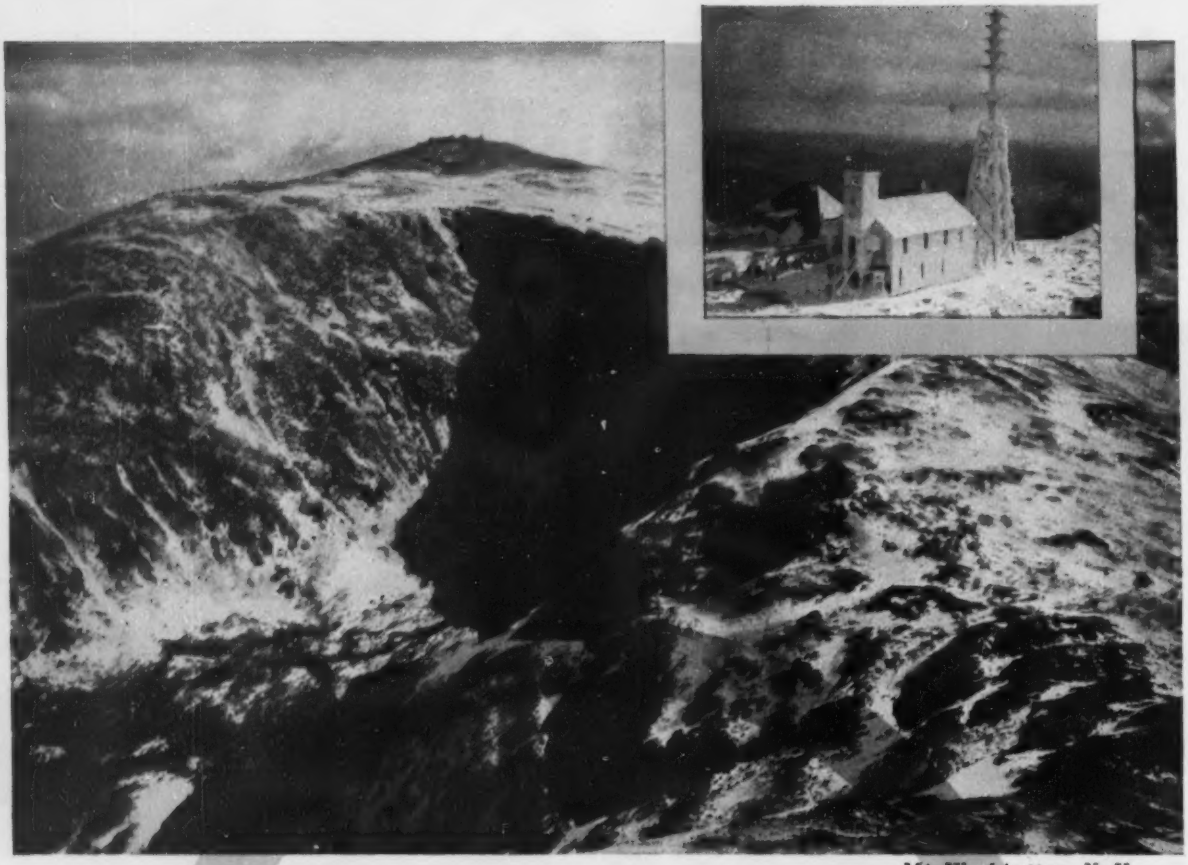
Supercharged cooling by Allis-Chalmers combines conductor-cooling with high velocity scrubbing action of gas over ample exposed area.

Developments like this prove you can count on Allis-Chalmers for pace-setting engineering leadership. It will pay to consult the A-C office nearest you when planning begins. Or write Allis-Chalmers, Milwaukee 1, Wis., for more information.

CHALMERS

A-C ALLIS-CHALMERS

A-4479



Mt. Washington, N. H.

IN 1870, sixteen years after the founding of the Kerite Company, a group of men headed by New Hampshire State Geologist, C. H. Hitchcock, established a permanent weather station on the isolated summit of New Hampshire's Mt. Washington. Needed for the regular transmittal of weather data between the outpost and the railroad station three miles below was a reliable communications line capable of withstanding the severe weather conditions of frost, snow, high winds and low temperatures. General A. B. Myer, Chief Signal Officer of the United States Army, conscious of the requirements, furnished Kerite insulated cable. This confidence expressed by General Myer and by responsible individuals in the many fields in which Kerite has been used through the years has been warranted by unexcelled performance records.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

Control of Residential Loads

"To everything there is a season and a time for every purpose under the heaven."

This quotation from the Bible—Ecclesiastes, chapter 3, verse 1, if you want to check it—expresses the thinking of Electrical World in respect to control of residental loads. We believe that the season is past for control of electric water heating and that the season is here for considering control of radiant or other resistance type electric house heating, assuming that it is possible.

The number of electric water heaters now in use in this country is about 6.5 million, about 15% saturation (EW, Jan. 25, p 232). The diversified demand per heater in uncontrolled operation declines consistently, irrespective of tank sizes and wattages, as the number of heaters increases up to 1,000 in a group (EW, Nov. 23, 1946). Possibly it would continue to decline if the grouping were carried above 1,000, but we have no evidence for that. In 1930, the late Harry Snow, then controller of the Detroit Edison Co, said in Electrical World, "It makes only a little difference at the power house whether high-wattage or low-wattage heaters are used."

These three references add up to a two-part idea. First is the thought that every electric utility that really has been promoting the load must have enough water heaters on its lines that the bug-a-boo of high demand, scaring many away from uncontrolled operation, has just quietly evaporated. The second thought is that if there were little to choose at the power plant between high and low-wattage heaters in 1930 when average annual residential usage was 547 kwhr and if it is assumed that increase in distribution capacity has kept up pretty well with growth of usage to around 2,500 kwhr today, then the need for concern about wattage of water heaters has also evaporated. Which is to say that we think the water heater load is now grown up and can safely be freed from any control.

When the water heater was new in the electric appliance scene, its annual usage of 3,000 kwhr or more towered high above the then average residential usage of 300 kwhr or less. The disparity struck terror into the minds of utility management. Obviously the monster must be controlled if it was to be coaxed into the family of electric service. The then situation of the water heater load is paralleled today by that of the electric house heating load—2,500 kwhr residential average as against 12,000 kwhr and up for heating. The same need exists for control of the new load at least until its characteristics are firmly established when, if its nature permits and increase of system facilities has kept pace with its growth, it can be set free.

There was question as to the practicability of control of the water heater load. The same question arises in respect to house heating, particularly where there is no offsetting summer air conditioning. It took a long time and a lot of investigation and argument to settle the question as it concerned the one load. The industry cannot get started too soon towards settling it in terms of the other.

A Nov. 2 Reminder

Tomorrow is the day!

The ballot box in your own precinct is the place.

The most direct way that you can make your own influence felt in Washington during the next two years is to place an X beside the names of the candidates of your choice on the ballot.

Remember that power policy is a hot issue in seven states. Taxes and other national issues figure in most Congressional elections.

It is a count of the ballots and not warmed-over predictions that will decide who represents you in Washington, in your state capital, and in your local council.

Vote tomorrow.

More Meters—Not Less

Competition is keen among those who must paint a rosy picture for the civilian atomic power industry, and we're reluctant to tilt a lance at every extravagant claim. We can't help from noting, however, that Atomic Energy Commission Chairman Strauss is now in the fray with the statement, "It is not too much to expect that our children will enjoy in their homes electrical energy too cheap to meter." In a subsequent public statement, Strauss went a step further, "I hope to live to see it."

Unless Chairman Strauss is holding out on us and some of his top experts at AEC, the only practical route toward economical atomic power still involves the turbine cycle along with conventional transmission and distribution facilities. The only cost that his magic atom will replace in the power equation might possibly be the fuel costs.

Now suppose atomic fuel runs just half that of conventional fuels, such as coal, oil, or gas. This would reduce the average residential rate per kwhr by a mere 1.5 mills—or from 2.7 to 2.55¢. Suppose you get the atomic fuel free. The average residential rate per kwhr would still be 2.37¢. Welcome as this reduction would be to customers, it would hardly justify tossing out all the meters.

Within the past seven years, the average residential rate has dropped nearly 3 mills per kwhr. During that same period, nearly ten million meters have been added. On that basis, we do look for a continued reduction of residential rates. But we also look toward much larger use per customer and a great many more customers—with a meter for each and every one.

A New Tool for Some Deeper Plowing

Publication of the new Residential Wiring Handbook (EW, Sept. 20, p110) brings the same question a Greek farmer asked when given a Marshall Aid tractor: "Now that I've got it, what do I do with it?"

And like the Greek's tractor, it is a tool—a tool for use in a field that could readily use some deeper plowing.

The new handbook, among other things, raises the standard for wiring adequacy to a minimum of 100 amp for service entrance capacity in all housing up to 3,000 sq ft of floor area. The National Adequate Wiring Bureau's Executive Committee has adopted it as the basis for its entire certification program. It has the blessing of every segment of the industry plus the National Association of Home Builders. The booklet, in fact, follows the Home Builders' own decision last spring to adopt voluntary 100-amp minimum standards.

How to use it now that we've got it? Two ways:

First, get as wide a distribution as possible. Here the utility, as in most ventures of a local nature, will have to take the lead. It must place the handbook in the hands of every architect, home builder, electrical contractor, lending institution—in fact everyone in any way associated with the designing, building, buying and selling of new homes and the renovating of old ones.

Second, use the handbook's new 100-amp minimum standard only for what its name says it is — a minimum. Utilities in all their promotion should stress this fact. The new standard has been too hard gained to permit any backing away from it. To do so would be as pathetic a misuse of our new tool as it would be for our Greek friend to hitch a horse to his tractor. The 100-amp service entrance is modern home wiring's "squeak-by" point, nothing more.

And why stop at a 100-amp minimum? Is it to be considered a "be all, end all"? Emphatically not. There is already talk of 200 amp.

Cool Talk

Talk of not wanting the electric househeating load by some quarters in the industry now has people on the outside saying the same thing.

A Tacoma, Wash., fuel oil dealer has publicly declared (see page 137) that the electric utilities, in his area at least, "are working feverishly to quiet down any talk of heating by electricity."

This statement was most likely made without damaging intent. But it gives added ammunition to the verbal guns of those who would have the public believe the electric utilities are not meeting their responsibilities.

A Bigger Job Still Remains

While it was developed primarily to show the public at large what electricity can do for the farm family, the new Diamond Jubilee Farm near Carlisle, Pa. (EW, Sept. 27, p 42) holds still another significance for utilities and others in the industry.

Here is a farm using five times more electricity than the average in the country: 150 kw of connected load, 60 electric motors, a dozen different heating applications. It's electrical equipment includes everything from grain crimpers to fly sprayers.

Yet the farm's entire electrical setup is engineered to be supplied from single phase service—the very same that runs to nearly every wired farm in America. What's more, not one single application is experimental. Every appliance and piece of equipment used is on the market, ready to be put to work.

If the Jubilee Farm does nothing else, it visually "cuts out the work" that the industry for some time now has known it faces: That of serving heavy rural loads with a low cost system.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Activities marking Light's Diamond Jubilee reached a peak last month with many plant dedications, TV show, and special celebrations.

Supporters of Dixon-Yates contract ready their defense of power supply proposal to be presented at hearings opening this week before Joint Congressional Committee on Atomic Energy.

Arkansas P&L, Middle South subsidiary, is criticized by banker, ex-governor at Langer hearings.

Lapp Insulator Co dedicated its $500,000 John Lapp High Voltage laboratory in Le Roy, N. Y. . . . Victor Insulator Co is increasing its electrical and mechanical testing facilities at its Victor, N. Y., plant . . . Porcelain Insulator Corp breaks ground for new 25,000-sq ft addition to its Lima, N. Y., plant. It will house a kiln and additional assembly and testing facilities.

Questionnaire to determine types of electrical equipment wanted and now being used by nation's farmers is being planned by Inter-Industry Farm Electric Utilization Council, following a second national meeting held in Chicago on Oct. 29.

As part of its roundup of information on damage and restoration of services in recent hurricanes. Massachusetts Department of Public Utilities announced it is making a survey of the cost of placing power and telephone lines underground. Bills which would require utilities to place overhead lines underground have been filed for consideration by the 1955 Massachusetts legislature as a result of the hurricanes.

About 6,000 of the Stevens County, Wash., Public Utility District's 23,000 customers have been contacted and 80% of them favor holding a special election on the Washington Water Power Co proposal to purchase outright the PUD, the company said recently.

Central & South West Corp receives silver oscar for the best annual report for 1953, of all public utilities in the 10th annual competition sponsored by "Financial World." American & Foreign Power received one for the best report of all Latin America. Another silver oscar went to Shawinigan W&P for the best report of all Canada.

Sale of household appliances by Connecticut L&P will be confined, effective Jan. 1, to those which "contribute more directly toward fullest use of the company's facilities."

Virginia E&P is making available a 36-page brochure, titled "The Chemical Industry Grows With Virginia." For copy, write Walter I. Dolbeare, vice president in charge of area development, Richmond 9, Va.

Off the Washington Wire . . . FPC named Henry R. Domers to the new post of executive officer . . . Robert W. Jennings, Alaskan district manager for Reclamation Bureau, was named director, Region 5, Amarillo, Tex., succeeding the late H. E. Robbins . . . Ethan N. Pendelton, vice president, American Brass Co, is on six-month loan, without pay, as head of the copper division in Commerce Department's business and defense services administration.

Bureau of Reclamation reported increased storage of water in reservoirs of Upper Colorado River Basin, northern watershed of Columbia River Basin, southern part of Missouri River Basin, and northern California.

Geological Survey's latest water map shows serious drought continued throughout September in the southern two-thirds of U. S., becoming critical in the southeast. Runoff was in the normal range in more than half of the U. S. and most of Canada. Annual flow of Mississippi and Colorado Rivers was second lowest on record, while flow of other rivers, Fraser, Columbia, and St Lawrence, was above normal.

Aluminum Co of America asked FPC for license to build $10 million hydro dam on Little Tennessee River. Under 1940 agreement, dam would be put into TVA system.

Black Hills P&L asked FPC approval to issue 9,950 shares of $100 par cum preferred and 40,000 shares of $25 par cum preferred stock.

Central Vermont Public Service Corp Pres A. A. Cree has found it "economically unacceptable" to agree to buy power under the Walter von Tresckow proposal from a hypothetical 187,500 kw steam plant on Lake Champlain.

Research to utilize sun power and to convert nuclear energy directly to electricity was urged by Dr J. E. Hobson, Stanford Research Institute, in addressing Texas Power Distribution Conference.

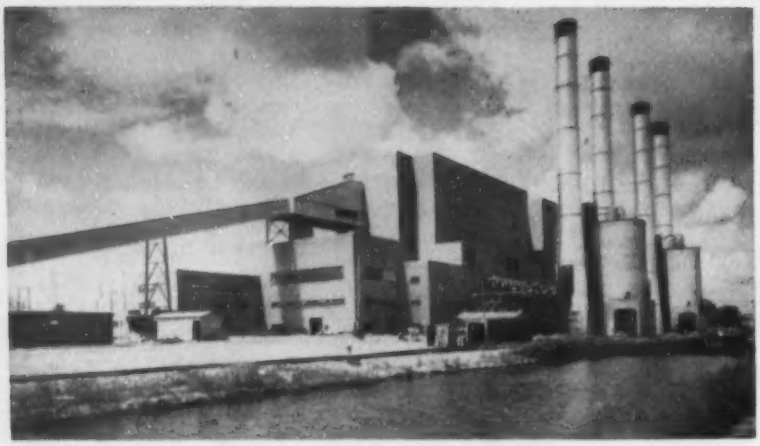
Colorado cooperatives are weighing plans to set up a $25 million generating and transmission system.

Westinghouse Electric reported net income of $62,644,000 for the nine months ended Sept. 30 compared with $53,219,000 in the same period of 1953. This set a new earnings record for the first nine months. In addition to a regular 50¢ a share common stock dividend, Westinghouse will pay Dec. 1 a year-end extra of 50¢ a share.

Executive Changes . . . Green Mountain Power has advanced Vice Pres Glen M. McKibben to executive vice president and John H. Baker, manager of operations, to the post of operating vice president.

Activities Marking Light's Diamond Jubilee

New Plants Push U.S. Capacity Over the 100-Million Kw Mark



Detroit Edison's St. Clair Plant

About 400 persons, including representatives of civic, local government, and industry groups were on hand Oct. 21 when Detroit Edison Co's St. Clair station was dedicated. The plant, which cost more than $75 million, has a capability of 625,000 kw.

John Edison Sloane, grandson of Thomas A. Edison, unveiled a bronze plaque at the plant site.

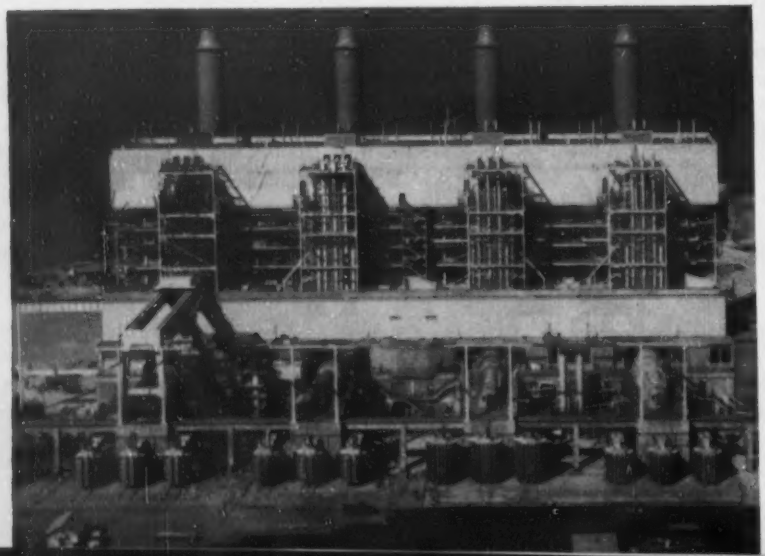
Feature of the dedicatory ceremonies was starting up of the fourth and final 156,250-kw unit by Col H. S. Bennion, managing director of Edison Electric Institute.

Ohio Edison's Niles Plant

Ohio Edison Co held dedication ceremonies for its $35-million plant at Niles on Oct. 21. The utility's president, Walter Sammis told 2,500 guests that use of power would be doubled in ten years.

A 75-year-old retired Ohio Edison employee formally dedicated the 212,-000-kw plant by giving the signal which set off fireworks and turned floodlights on the new station.

The day after the dedication, the plant was opened for public inspection. In a three-day period, 12,607 persons visited the station.



PGE's Pittsburg Plant

Dedication of the $75-million Pittsburg steam plant of Pacific Gas & Electric Co was northern California's feature event in the celebration of Light's Diamond Jubilee. Climaxing the ceremony as the plant's first two 150,000-kw units came on the line. was the illuminating of a 75-kw lamp, the world's largest electric light.

Pittsburg station, largest steam-electric plant west of the Mississippi River, will add 600,000 kw to PG&E's generating capacity when third and fourth units of 150,000-kw go into operation at the end of this year.

Reach Peak During October

Celebration at Lighting Headquarters of World

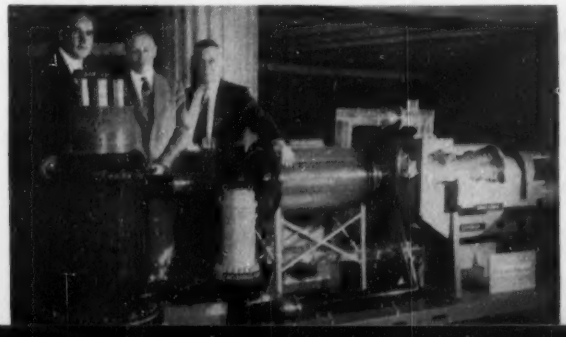
Leading figures at civic banquet held at Nela Park Oct. 21 to honor Edison were Donald L. Milham, General Electric Co vice president, George C. McConnaughty, Federal Communications Commission chairman; and Elmer Lindseth, Cleveland Electric Illuminating Co.

Rockland L&P Honors Jubilee Customer

Rockland Light & Power Co paid a birthday tribute to Mrs Cathleen Elwood, Cresskill, N. J., born 75 years ago on Oct. 21. Mrs Jean Paul, home economist for Rockland L&P and Charles Caldwell, vice president, present Mrs Elwood with lamp as her son and friends look on.

Duquesne Puts Atomic Plant Model on Display

As part of its observance of Light's Diamond Jubilee Duquesne Light Co put on display during October a model of an atomic power plant. Pictured beside the model are Phillip Fleger, Duquesne chairman, and W. J. Lyman and C. T. Sinclair, Duquesne vice presidents.



TV Critics Say . . .

. . . Light's Jubilee program had something to please everyone, but lacked unity

The two-hour, all-network Light's Diamond Jubilee television program Oct. 24 provided a broad band exercise for the TV critics. All of them found something to praise about the show, but most of them found that the special program had some shortcomings, too.

'Fine Show' . . . Jack Gould writing in the New York Times characterized the program "A fine show!" He went on to say that the electric industry sponsored extravaganza was ". . . a striking cavalcade of the American individual."

Unlike his colleagues, Gould was able to find a theme for the program which he described as ". . . the development of the American character . . ."

Gould noted there were no conventional commercials, but said "references to the lighting industry were rather generously incorporated in the narration."

Criticisms . . . Other critics were less kind. Here are excerpts from early columns:

Harriet Van Horne, New York World-Telegram: "Naturally, there are bound to be a few brilliant moments when you've got stars of that caliber at work. But looking back over the Jubilee as a whole, it generated little light, scant heat and no excitement."

Jay Nelson Tuck, New York Post: "It was a gigantic plum pudding containing enough nuggets so that there had to be something to please almost any conceivable taste but held together . . . only by the loosest kind of dough."

Leo Mishkin, Philadelphia Inquirer: "But even with narration by Joseph Cotten supposedly tying the whole business together, even with its references to the light of learning, the light of faith and the light of kindness now illuminating our American society, the vast and sprawling pageant still lacked cohesion, still wanting a motivating force, still failed to march toward a stirring and moving climax."

Dixon-Yates Backers Prepare Defense

AEC, utility companies concerned with controversial contract will be called on to explain and justify provisions of power proposal when hearings open this week before Joint Congressional Committee on Atomic Energy

With hearings scheduled before the Joint Committee on Atomic Energy Nov. 4, the Atomic Energy Commission and others concerned with the controversial Dixon-Yates contract are preparing their defenses against an expected public power onslaught.

AEC General Manager Kenneth D. Nichols and R. W. Cook, assistant general manager, probably will head the list of witnesses to explain the proposal. Dixon-Yates officials and public power opponents also will be on hand.

Purpose of the hearing is to consider AEC's request that the joint committee waive a required 30-day waiting period while Congress is in session to permit the signing of the contract this fall.

The Nov. 4 hearing will be the first opportunity advocates of the contract have had in several months to combat the semi-official attacks of opponents of the proposal. Sen William Langer's anti-monopoly subcommittee has been hearing testimony from Dixon-Yates foes.

Arguments for Contract

These arguments can be expected in favor of the contract.

• TVA asked for, and was refused by Congress four times, funds with which to build a similar steam plant at Fulton, Tenn., not too far from where Dixon-Yates proposes to construct its plant. The need for a plant in this area was, and is, real, whereas arguments in favor of building a plant nearer Paducah do not hold water for economic reasons.

• Location of the plant on the Arkansas side of the Mississippi River will make it possible for new industries to locate in a power-rich area of Arkansas, rather than being forced, if they wish this location, to begin operations on the more-crowded Memphis side of the river. Neither Middle South Utilities, Inc, nor Southern Co (who make up the Dixon-Yates group) do business now in Tennessee, and neither wishes to invade this TVA sector.

• Location of the plant outside Memphis meets the need for dispersal of vital industrial facilities, endorsed by the government's mobilization agencies.

• Location of the plant at West Memphis, Ark., means that back-up power to keep AEC's plant rolling will be available from the Dixon-Yates systems.

• AEC has absolute call on up to 600,000 kw of the plant's 650,000-kw net capacity for 35 years—a long time in the life of an electric utility plant, whether steam or hydro.

Mississippi Valley Generating Co, which is the Arkansas generating firm established by the Dixon-Yates group, guarantees this firm power to AEC, except in unusual circumstances, such as flood, fire, strikes, or other acts of God or of violence. To accomplish this, Mid-South and the Southern Co propose to arrange to make available to their subsidiary systems whenever needed the "excess" 50,000 kw of the net capacity of the new plant not contracted for by AEC. In turn, the operating companies they own will make available to Mississippi Valley Generating some 200,000 kw of capacity whenever one of the three units of the new plant is inoperable. Since the new company will install only three units, which together would be needed constantly to turn out the 600,000 kw needed by AEC under the contract, this precludes the possibility that AEC will ever, during the life of the contract, have to curtail operations while a Dixon-Yates unit is down for repairs or reconditioning.

• The firm cannot make more than 9% on its equity investment of $5.5 million. If construction costs exceed the estimated $107 million, even this return will be pared down. AEC and the new firm will share in footing the extra bill. In the event costs rise substantially, to more than $117 million, AEC stops paying on the increase and the company foots the entire bill for the increase in cost. Since the contract proposal was first broached, cost estimates have crawled upward.

• AEC can cancel at any time on three years' notice. The only serious qualification to this arrangement leaves the company in a position of risk. If AEC desires to cancel, it must first ask TVA if it needs the power. If TVA does not need the power, or can arrange to get it elsewhere, AEC's cancellation takes effect within three years. During the fourth year, Dixon-Yates is obligated to withdraw from, and take off the bill of, AEC at least 100,000 kw of power. This represents one-sixth the capacity for which AEC contracts. During each of the succeeding five years, Dixon-Yates agrees to stop delivery to AEC of another 100,000 kw, until the entire output of the plant has been channeled elsewhere. This means that AEC, upon cancellation, will cease each year paying for one-sixth of Dixon-Yates power, thus permitting the contract to lapse within a total of nine years.

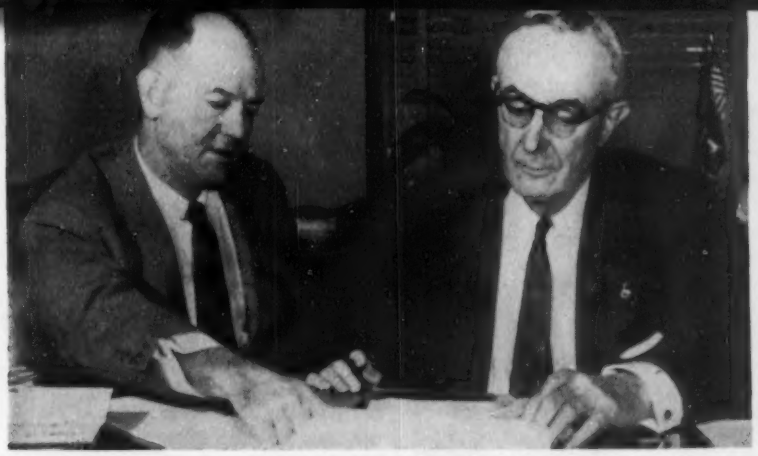
Public Saving

• Private construction of the new plant will obviate the need for a $100 million public investment in a steam generating plant for which need might disappear in the future.

• Construction of the plant soon will give the Administration time to decide what to do about private or public power expansion in the area, while at the same time continuing service to the TVA area.

• All government agencies who have played parts in drawing up the contract, or as consultants, have ruled favorably on the arrangement. This includes TVA, which at first vigorously protested AEC's method of contracting.

If the majority of the joint committee is on hand for the hearing, there are enough votes to get the 30-day waiver. The committee will be told that precedents exist for this method of supplying AEC with electric power. Electric Energy, Inc, and the Ohio Valley Generating Co both are joint holding company ventures ruled upon favorably by the Securities and Exchange Commission.



R. E. RITCHIE (right) Arkansas Power & Light president, reads complaint asking $2 million damages against A. E. McLean. At left is Eugene Warren, the utility's attorney

LITTLE ROCK BANKER McLean, shown as he testified before the Langer subcommittee

2nd Mid-South Firm Attacked

Former governor and Little Rock banker criticize Arkansas Power & Light Co at hearing before Langer subcommittee

Another subsidiary of Middle South Utilities, Inc, the holding company which makes up 79% of the Dixon-Yates organization, came in for attack last week before Sen William Langer's anti-monopoly subcommittee.

This time it was Arkansas Power & Light Co, a totally owned Mid-South subsidiary, which was attacked by former Arkansas Governor Sid McMath, a Democrat, and Little Rock, Ark., banker Arthur E. McLean, a Republican, both of whom have been feuding for some time with AP&L officials.

A week before it had been Mississippi Power & Light Co., which was attacked, along with Mid-South, by J. D. Stietenroth, ousted MP&L secretary-treasurer.

And again, the charges were heard without any testimony from the utilities executives on their side. Langer has publicly invited utility people to testify, but has not yet set any dates to hear them.

McMath and McLean would seem to have opposite viewpoints, and on most things they do. But they got together on their charges that Arkansas P&L is "the most powerful political force in Arkansas," that it "is the only utility in the state which sought to dominate and put the fear of God in the people," that it used money and influence in state elections, and that it was the "most corrupt and ruthless corporation that ever operated within the bounds of the state."

McLean's feelings and outspoken remarks, delivered not only in his testimony before Langer, but in letters and statements at various places over the last several years, have prompted a $2-million slander suit, brought against him by AP&L the day after he appeared in Washington.

Arkansas P&L's Pres R. E. Ritchie declared McLean's statements were "so unfounded and so completely ridiculous that I do not care to make further comment than to say categorically that they are absolutely untrue."

The suit, in turn, brought an immediate blast from Langer, who pounded the committee table and declared the action was an attempt at "intimidation", intended to "bluff" his witnesses. He said AP&L made a "major blunder" in filing suit. McLean said darkly, "They're asking for it," and promised Langer to relate the history of the 1920's when he served on the board of directors of the now-defunct Bankers Trust Co with present-day AP&L officials.

McLean made several charges, particularly about individuals who are executives in the firm. He made it clear for the record that he was not questioning the honesty or integrity of the company.

Most of his testimony was directed at protesting a recently-requested $3.9-million rate increase by AP&L.

The firm's application for increased rates was filed with the Arkansas Public Service Commission about four months ago, and put into effect under bond, to be refunded if the PSC refused it. McLean's attempt to show that AP&L for the last few years has been returning from 10 to 11% on stock held by Mid-South, and that, therefore, any request for further increase in rates was unjustified.

He also testified:

- "If Dixon-Yates is a fast-negotiated deal, we may see the Eisenhower Administration sold down the river because of the greed of a few for a few million dollars."
- AP&L's directors, though they have said they made the decision to ask for a rate increase, were "directed" to do so, and the decision was in the hands of Mid-South. McLean said that on one occasion, C. Hamilton Moses, chairman of the AP&L board, "pleaded" with Edgar Dixon, President of Mid-South, not to go through with the rate increase.
- McLean said Moses was wrong when he said Massachusetts Investors Trust sold 100,000 shares of Mid-South common stock because it was not returning 6% on its investment. He filed in the record a July 14 letter to Moses declaring that, as of Dec. 31, 1953, the investment firm had held 114,700 common shares and that information given him later showed that, as of June 30, 1954, the Massachusetts firm still held 100,000 shares.

McMath has attributed his defeat in a reelection bid to the action of several of the company's executives. He testified:

- There is a definite connection between the pending AP&L rate increase and the Dixon-Yates contract.
- AP&L was the "most powerful political influence in Arkansas," it was "unhealthy" and used money to influence the 1952 elections to defeat McMath, who had publicly indorsed building a steam plant at Ozark, Ark. by a group of REA cooperatives.

Appointed to AEC

Dr John von Neumann, Princeton scientist, becomes fifth member of the commission

Dr John von Neumann, 50-year-old mathematics professor at Princeton's Institute for Advanced Study for 20 years, has been appointed the fifth member of the Atomic Energy Commission.

This is the first time in its short history the AEC has had two scientific members on its governing board. Latest appointment in this field was Dr Willard F. Libby, University of Chicago chemistry professor, who replaced Dr Henry DeWolf Smythe (EW, Sept. 27, p 8).

Like Libby, von Neumann has served for several years as a member of AEC's general advisory committee.

Replaces Zuckert . . . The new commissioner succeeds Eugene M. Zuckert, whose term expired June 30. He is a political independent, according to the White House announcement of his appointment. Libby and two of the other three members of the commission—Chairman Lewis Strauss and Joseph Campbell—both appointed by Eisenhower, are Republicans. Commissioner Thomas E. Murray, a Truman appointee, is a Democrat.

As he accepted the five-year appointment, von Neumann reaffirmed his confidence in Dr J. Robert Oppenheimer, wartime atomic bomb project supervisor and still head of the Institute for Advanced Study, whose security clearance has been withdrawn by the government.

DR JOHN VON NEUMANN

Born in Hungary . . . Von Neumann is a naturalized American who was born in Budapest, Hungary. He became a U. S. citizen on Aug. 1, 1937.

He became a professor at the institute four years before that time. Since then he has also served as chairman of a special nuclear weapons panel in the Air Force's Scientific Advisory Board, and has been a consultant to the Central Intelligence Agency.

Both Libby's and von Neumann's appointments are subject to Senate confirmation.

New Atomic Group

Detroit Edison seeks AEC's approval for newly formed unit following Dow's withdrawal

Detroit Edison Co has asked Atomic Energy Commission to approve formation of Atomic Power Development Associates, a research organization devoted to study of electric power generation from atomic energy. The group's membership would consist of 23 members of the Dow-Detroit Edison group and nine proposed new companies to bring the total to 34.

The new organization succeeds an industrial atomic power development project started in 1951 by Dow Chemical Co and the Michigan utility.

Dow to Quit Group . . . Dow Chemical just recently requested AEC permission to withdraw from the Detroit Edison group. Leland I. Doan, president of Dow, explained his company's decision by saying studies had reached a stage where participating firms have crystallized their individual interests.

"In our case," Doan said, "we are primarily interested in the chemical aspects of atomic power and the possible utilization of nuclear reactor by-products in the chemical industry."

Group effort will go forward, without Dow, concentrating on design and eventual construction of an economic commercial power reactor. To date, participants have already invested or committed $4 million in the project.

Cites Group's Goal . . . Speaking for Detroit Edison, Walker Cisler, president, said, "The Dow people have contributed much to our present understanding of the basic problems related to the development of atomic power and peacetime atomic uses. Our studies have progressed to the point where the paths we believe we should follow are clearly defined.

"It is now becoming increasingly evident," he continued, "that the development of atomic energy for the generation of electricity should be realized at the earliest possible date, and our efforts must be directed chiefly toward that goal."

Cisler concluded that the Atomic Power Development Associates group would continue work on an atomic power reactor of the breeder type.

AEC OKs Atomic Study by Rocky Mountain Group

Atomic Energy Commission has authorized a nuclear power study by a newly formed association of nine companies known as Rocky Mountain Nuclear Power Study Group.

The new group will be composed of these companies: Arizona Public Service Co, Ebasco Services, Inc, Fluor Corp, Ltd, Idaho Power Co, Minnesota Mining & Manufacturing Co, Phillips Petroleum Co, Public Service Co of Colorado, Riley Stoker Co, and Utah Power & Light Co.

This group will study at its own expense the economic and engineering possibility of a nuclear power reactor for the western United States. It will first study feasibility of a reactor, cooled and moderated by light water, fueled with slightly enriched uranium and designed for producing both power and fissionable material. Then the group will investigate feasibility of other reactor types.

Companies will assign ten full-time employees to the one-year study. In addition, each company will contribute $5,000 to defray costs.

Headquarters for study group personnel will be established at Idaho Falls, Idaho.

Chairman of the group's management committee is George M. Gadsby, chairman of board of Utah Power & Light Co. Vice chairman of committee is Dr R. L. Doan of Phillips Petroleum.

Atomic Energy Uses Studied

Industrialists and atomic scientists at New York conference analyze developments, utilizations of nuclear power

Progress and prospects of world-wide developments of peacetime uses of atomic energy were scrutinized at the National Industrial Conference Board's third annual conference on atomic energy held Oct. 13-15 at New York.

The three-day parley attracted more than 2,000 industrialists and atomic scientists from the United States and abroad. These delegates took part in round table conferences that ranged from a philosophical discussion of atomic energy to economic factors in locating reactors.

Calls for A-Pool Aid . . . President Eisenhower, in a message read at the conference's dinner-session, called upon American industry and leaders in technology to aid in development of the proposed atomic pool aimed at harnessing the atom's vast energy for the building of a better world.

The President's message was read by Dr Willard F. Libby, newly appointed member of the Atomic Energy Commission. Keynote speaker at the dinner, Dr Libby discussed the everyday use of radioactive isotopes. He said that "a great deal of the promise of the President's atomic pool plan lies in the field of isotopes."

The hope of mankind lay in the collaboration of nations in harnessing atomic energy for human welfare, Dr Niels Bohr, director of Institute for Theoretical Physics, Copenhagen, told the conferees.

Dr Bohr, a Nobel prize winner, said, "It is more necessary than ever that the various nations come into such peaceful collaboration so that unprecedented dangers to civilization can be avoided and the nations together can reap the fruits of science."

At a round table conference on the outlook for atomic power costs, F. C. Gronemeyer, principal development engineer, Fluor Corp, described a dual purpose pressurized reactor, using enriched fuel and cooled and moderated with light water.

Gronemeyer said the atomic plant, which would use uranium-235 as fuel, would produce in addition to electricity, plutonium, another atomic fuel. He said the plant, which would generate between 60,000 and 300,000 kw, would include the atomic furnace, a steam-electric generator, and a chemical processing apparatus for recovering the plutonium from the atomic reaction in the furnace.

DR BOHR: World atom collaboration needed

Cites Kw Plant Cost . . . The plant, he continued, could be built now at an installation cost of $174 per kw. This type reactor would produce power for 5.5 mills to 7.75 mills a kwhr, he added. This, he went on,

(*Continued on page* 167)

Grant PUD Gets Preliminary Permit for Priest Rapids

Shortly after the Grant County PUD of Ephrata, Wash., received word that it would be issued a preliminary permit of Federal Power Commission for a 1.2-million kw hydroelectric dam on the Columbia River at Priest Rapids, PUD Manager Grant Smothers reached a tentative agreement with the Washington State Power Commission. The PUD will spend $500,000 on engineering studies for the $365-million project.

The Agreement . . . Approved informally by the power commission at a later meeting, the "memorandum of understanding" provides that:

1. The commission will not object to the FPC's granting of the preliminary permit, although it reserves the right to apply for a license itself on the same project.

2. The PUD will proceed with the preliminary engineering, making data available to the commission. Should the commission later be granted a license to build the dam, it agrees to reimburse the PUD for money it has spent on the project.

3. Liaison will be maintained between the two agencies in prosecuting the preliminary engineering and investigation.

4. If the project is developed by the commission, the PUD will be assured enough power to meet the needs of its service area.

J. Frank Ward, managing director of the commission, pointed out that the preliminary permit does not give the PUD priority to construct the dam.

Accord was reached at a meeting sponsored by representatives of the Seattle, Tacoma and Spokane Chambers of Commerce. It does not attempt to prevent court litigation over the project and the commission, in fact, expressed its intention to press for an early decision in a case brought by the PUD challenging the commission's constitutionality. The Grant County Superior Court recently issued a restraining order barring the commission from proceeding with efforts to undertake the dam project until the commission's legal authority can be determined. The commission had applied for a preliminary permit.

The PUD had agreed with the FPC that it would not object to the filing of an application by the state commission for a license to build the project after the commission's legal competence has been determined by the courts.

Association of Edison Illuminating Companies

Committee reports covering progress in management, research, technology, and sales reflect

Atomic energy, industry load growth, electrical equipment, design progress, and electric heating and cooling were among the topics discussed at the annual meeting of the Association of Edison Illuminating Companies, Oct. 7 to 9. The meeting at White Sulphur Springs, W. Va., was one of the most successful in recent years. Attendance was swelled by the presence of junior executives of member companies.

G. W. Van Derzee, president, Wisconsin Electric Power Co, and A. D. Barney, chairman, Hartford Electric Light Co, were re-elected as association president and vice president. Two new directors were elected, Lyle McDonald, chairman of the board, Public Service Electric & Gas Co, and Charles E. Oakes, president, Pennsylvania Power & Light Co.

Opening the session, G. W. Van Derzee, president, traced the history of the organization back to 1885 when the name was adopted by a group of electric company officials meeting in Pittsburgh to discuss mutual problems.

At the third semiannual meeting in 1887, Van Derzee noted that a uniform system of account books was approved. Creation of several standing committees was traced back to those early years.

Commenting on a letter which grew out of the 1887 meeting, Van Derzee said, "It might have been written today." It told of the technical and management problems which faced the infant industry at that time and called on companies to exchange information to the mutual advantage of all.

Chairman Jerome K. Kuykendall of the Federal Power Commission reviewed the Eisenhower Administration's partnership program for developing hydroelectric potential. He said federal agency studies now being conducted indicate numerous opportunities for joint development of waterpower by federal and non-federal interests. Among possibilities are sites on the Ohio where navigation structures must be modernized, sites in the Arkansas, White, and Red River basins, Tygart River reservoir in West Virginia which is now operated for flood control and water supply, and sites on several streams in the Pacific Northwest.

Scientific approach to management selection is paying off at Wisconsin Electric Power Co. F. L. Larkin, vice president in charge of the company's personnel services, told how its elaborate system of personnel evaluation has unearthed management talent formerly "buried" in the organization. Besides creating a reservoir of known management talent, the Wisconsin Electric program also enables management to plan each move for training and experience purposes in connection with promotions and transfers.

"One of the most heartwarming results of the evaluation procedures," Larkin said, "is the discovery of management talent which is buried in the organization and, in many instances, would have remained so." Most dramatic instance cited was the discovery of hidden talent in an employee assigned to the boiler room of one of the company's oldest steam plants. Today the employee is engineer-in-charge of one of the company's newest and largest steam plants.

Committee on Power Generation . . Nearly half of the capability of new turbine generators ordered in the year ended April 30, 1954 were for TVA and to supply AEC installations according to B. C. Mallory, chairman. He also reported that fewer turbine generators (2 million kw) were ordered in those 12 months than for any of the past 10 years.

The fluctuations in new orders for major power plant equipment was described as "basically uneconomical." Mallory closed with the question "Is it possible for the industry, perhaps by cooperative action, to schedule new plant construction to smooth out the irregularities in orders placed for new equipment?"

Committee on Air Pollution . . . Reiterating points presented in earlier reports of his committee, A. L. Penniman, Jr., chairman, pointed out again "the importance of sulphur dioxide as a potential source of costly troubles and the need for research on removal of sulphur from coal at the mines."

It was reported that the association has sponsored a project at New York University for the review and evaluation of the scientific literature on the physiological effects of sulphur dioxide. The findings provide no evidence to indicate that exposure to sulphur dioxide in concentrations normally expected in the vicinity of generating stations has any ill effect upon healthy adults.

Electric Switching and Switchgear . . . W. F. Wetmore, chairman of the committee, reported that the new method of rating circuit breakers is still under study. This proposed method will rate circuit breakers according to initial symmetrical fault current rather than on the present kva basis. A test code will be prepared to include means for demonstrating the breaker's ability to interrupt currents with varying degree of asymmetry according to the breaker speed.

Progress was reported by Wetmore "on the standardization of bushings to effect interchangeability between manufacturers and apparatus. A working group has recommended adoption of a proposal covering both electrical and dimensional characteristics for bushings in the range from 23 to 69 kv, and electrical characteristics for the higher voltage ratings." Wetmore also stated that some work is in progress toward dimensional standardization of bushings 115 kv and above.

A standard has been evolved covering the wiring associated with the breakers and the terminal block arrangements, according to Wetmore. The committee believes that users and manufacturers can effect engineering and production economies by reducing the multiplicity of special control schemes.

Power Distribution . . . Committee Chairman E. R. Morse reported that the Wood Pole Research Program,

Celebrates 70 Years of Service

all-round industry interest of group

to which the association is contributing, is now under way. It is to cover a "determination of satisfactory test methods; effects of irregularities such as knots, spiral grain, etc on pole strength; and absolute values for design purposes for different species."

Of particular significance was the report that through its cable engineering section, the committee has taken preliminary steps to investigate the design, construction, and possible cooperative testing of cables in the range of 380 kv or 440 kv.

The difficulty of acquiring rights-of-way has been given considerable attention by the committee. Moore reported that considerable success is being achieved through use of existing railroad rights-of-way. In some instances master agreements between utilities and the railroads have been consummated. The committee is attempting to establish closer relationships through liaison with the Electrification Committee of the Association of American Railroads.

Moore reported that use of primary voltages as high as 27 kv for ac networks was being retarded by the higher cost of transformers. They range as high as 20 to 27% more than for 13.8-kv operation.

Substation costs have been given considerable attention by the committee. Comparisons are being made on a unit cost basis for different types to serve various classes of loads in different types of surroundings.

Metering and Service Methods . . . "The bottlenecks to further residential usage in the existing customer's service entrance and his wiring and outlet facilities" was emphasized by H. H. Marsh, Jr., chairman of the Metering and Service Methods Committee. He pointed out that all too many of our existing 42 million residential customers are served two-wire 115 to 120 v. Minimum service connections with 100-amp switch and three No. 2 wires were advocated.

Marsh reported that the committee is presently engaged in reviewing all the effects of recent developments in

"For next year we have some constructive new approaches to problems of the electrical industry at large, involving coordinated work on several matters of common concern to utilities and to manufacturers. . . ."

G. W. VAN DERZEE

"Utilities ability to mold the shape of the load curve is limited . . . We must confine our efforts to building up emphasis on compensating loads."

MERRILL E. SKINNER

"The growth of summer air conditioning loads without offsetting winter seasonal uses should be of considerable concern to certain electric utilities."

L. V. NELSON

Sales Conference Stressed Electric House Heating and Adequate Wiring

an attempt to prepare an acceptable standard for calibration of general service meters.

Meterwise, Marsh stated that, "the industry is in excellent position to accept the foreseeable large increase in residential demand and in kwhr usage, and that the meters of today could and should be in use even longer than meters still in service today that were manufactured 30 years ago."

The committee feels that there is urgent need for a truly universal meter that could be used either single phase, two-wire and neutral from a 120/208 volt network, or as a 2½ element meter for 3-phase either 4-wire wye or 3-wire delta.

Manufacturers Comment . . . J. F. Roberts, vice-president, Allis-Chalmers Manufacturing Co, presented recent developments within his company. The use of aluminum in power transformers to reduce weight and improve efficiency was described. Roberts also announced his company's participation in a nuclear power reactor at Argonne (EW, Oct. 18, p104).

Francis K. McCune, general manager, Atomic Products Division, General Electric Co, commented on trends in nuclear power field. He stated that there has been a fantastic increase in the kw heat produced per dollar invested in reactors and predicts that it will continue. He feels that we stand on the threshold of economic power from atomic energy.

A. C. Monteith, vice president, Westinghouse Electric Corp, said there are now a number of types of reactors being considered, introducing intense technical competition. There is a fundamental rivalry between solid fuel and liquid fuel approach to nuclear power. This rivalry stems from the liquid fuel approach offering lower possible costs of preparing fuels for such a reactor as compared with preparing solid elements. He pointed out he has no hesitation in singling out the pressurized water plant as the most advanced technically and as the outstanding candidate for solid fuel leadership.

Load Research . . . L. V. Nelson, chairman of the Load Research Committee, appropriately centered on air conditioning and electric househeating in his report. "The growth of summer air conditioning loads without offsetting winter seasonal uses should be of considerable concern to certain electric utilities," he said.

He then revealed findings of recent air conditioning studies made by his group under Frank Knecht of Baltimore. Among them:

In Chicago it was observed that in commercial service air conditioner loads may be expected to reach their maximum demand at about 84 F. The air conditioning load may be expected to diminish with temperature and practically disappear at 61F.

In Detroit in a study of 19 ½-ton residential room coolers during the warmest summer week, there was found a direct variation with temperature in the average group demand during the day. The peak demand occurred within about one hour of the time of maximum temperature. Average coincident max demand of 600 watts per unit is 88% of the average individual max demands of the room coolers. An annual use of 260 kwhr per unit indicated a group load factor of less than 5%.

On electric house heating Nelson reported a study made by Constantine Bary of Philadelphia Electric Co. It was a compilation of test data and observations on 89 homes in eight Eastern locations which were heated entirely by radiant panels.

Sales Executives Conference . . . Merrill E. Skinner, vice president, Union Electric Co, delivered a roundup on the association's Sales Executives Conference held a few days earlier at Point Clear, Ala.

John B. Taylor, vice president, Atlantic City Electric Co, summarized reports on residential air conditioning, residential resistance heating, and the heat pump.

On electric heating Taylor said: "In a climate of roughly 5,000 degree days, about 1 kw connected per 1,000 cu ft of space is required; hence each 1 kw heating panel will consume about 1,500 kwhr a year," he said. "If we assume that demand responsibility at time of system peak is 70% of connected load (in our case at Atlantic City it is lower) a 1-kw panel provides 1500/.7 or 2,150 hours use of demand (25% annual load factor).

"In temperate climates without super low cost fuels," he continued, "it is believed that an average cost somewhere between 1.75 and 2.25¢ per kwhr is satisfactory to secure consumer satisfaction for a reasonable segment of the new residence market where the building is small and is designed for electric heat."

Quoting from an AGE analysis by Paul Brooks, he said that heat pumps installed in 35 homes in AGE system brought the cost of central air conditioning to between 10% and 23% of the home's total cost, depending on what its cost was. "We found that most home builders considered that the heating system alone should not exceed 10 to 12% of the home. We think that if builders are willing to spend up to 10 or 11% of their total price for heating and if the need and desire for air cooling is sold to the buyer, certainly, another 5 to 8% in the increased price can be sold for year-round air conditioning which can be provided in one piece of packaged equipment."

Inadequate Wiring . . . Harry Restofski, vice president, West Penn Power Co, pointed out that while much more can and should be done on an overall national basis, the bulk of wiring promotion must be done at the local level. He urged utility changes in requirements for wiring on customer premises. Reporting on a survey of 32 companies, he said that some already have made changes, 20 expect to increase their requirements, and four others have increases under consideration. "Apparently," he commented, "the tempo of increasing residential service entrance requirements is going to be stepped up."

Skinner then delved into the matter of load balancing by summarizing reports made on a panel discussion of which he was moderator.

- Utilities' ability to mould the shape of the load curve is limited. We cannot stop or retard applications which the customer wants and which tend to "run away" with us, for example room coolers and television. To try would be inconsistent with our service responsibility.
- Opportunities open to utilities to accomplish significant results are limited.

Maine Court Upholds Fair Value

The Maine Supreme Court remanded to the Public Utilities Commission of Maine the Central Maine Power Co's petition for a rate increase. It was contained in an order dated Oct. 10. This action was taken on the grounds that the PUC gave insufficient weight to the present fair value of the petitioner's property in arriving at the earnings to be allowed to the company.

The court noted that the PUC, by its decree of Nov. 6, 1953, increased rates initially by $750,000. Upon further consideration of the corporate income tax rate, the commission, on Nov. 18, 1953, ordered a further increase of $670,000, or a total of $1,420,000. However, the court noted that "these total revenues, however, are substantially less than those proposed by the company, and its exceptions properly raise here legal issues testing the decrees."

Determination of the Rate Base . . . The court went on to say "The first task of the commission in any rate case is to determine a rate base, that is to say, the **fair value for rate making purposes** upon which the company is entitled to earn a fair rate of return. This fair value is quite distinguishable from a fair value as a basis of purchase. It is in effect a composite ascertained and fixed by giving 'due consideration to evidence' of certain factors. The Legislature (has) enumerated these factors as 'the cost of the property when first devoted to public use, prudent acquisition cost to the utility, current value thereof, less depreciation on each; and any other factors or evidence material and relevant thereto' . . . As evidence of reproduction cost less depreciation would be material in any determination of 'current value,' it would be improper for the commission to exclude such evidence or fail to give it 'due consideration.'"

Among the exceptions which the company made to the PUC's ruling was the one dealing with prudent acquisition cost less depreciation. In this connection the order of the court said, "As has been stated, this factor is intended to reflect the difference, most often an excess, between the original cost when first devoted to public service and the amount invested upon acquisition. This factor brings into focus what the company **prudently** invested in the property and taken into account that property which is part of an established business often demands a higher price than its original cost.

Proving Prudence . . . "The company has the burden of proving its prudence in acquiring property, for the consumer cannot be compelled to provide the utility with an income on its unjustifiable and imprudent acquisitions. The commission did not determine any amount directly for this factor. It said, 'In this instance where the property connected with this acquisition amount has been substantially retired, we can give very little consideration to such amount in the rate base.'

"We do not construe this statement as meaning that the commission failed to give 'due consideration' to the factor. Rather does it appear that upon due consideration, having in mind that the acquisition excess over original cost first made its appearance many years ago, and the item being depreciable, the net result does not weigh heavily in the scales in assessing fair value for rate making purposes. We cannot say that the commission was in error in this determination. However, we cannot lose sight of the fact that this method of disposing of the factor of prudent acquisition cost less depreciation does nothing to diminish the impact of the error above noted in determining original cost less depreciation."

Fair Value Findings . . . With respect to the fair value findings of the PUC, the court said, "The witness (for the company) produced as a final estimate of current value (a depreciated figure) the amount of $163,986,139. In estimating a property of such size, perfect exactitude could neither be expected nor required. Certain errors were inevitable and the commission was duty bound to weigh the evidence fairly and, if necessary, reduce the estimate as the evidence and sound judgment might suggest.

"What the commission did was summarily to dismiss any evidence of current value in these words, 'Altogether, we feel that the witness, with his exhibit, has not produced a total figure which is satisfactory evidence of the current value required by the statute.' Starting with a depreciated original cost erroneously computed as $128 million, and disregarding prudent acquisition cost depreciated for reasons we have discussed, the commission determined fair value for rate purposes as $132 million which is only $4 million more than its own concept of the original cost depreciated. Yet it cannot be disputed that the factor of current value is **the only one** which in any way reflects the greatly increased costs which seem to have become implemented into our economy.

"We cannot escape the conclusion that the commission based its findings on a preconception that the legislature is in error in using current value as a factor. It is not enough to give mere token recognition of a factor imposed by legislative mandate. The factor, properly determined, must find appreciable reflection in the end result. In the light of what everyone knows about increased costs generally, we do not believe that an increase over original cost depreciated of barely over 3% is an appreciable reflection of the impact of inflation upon values. Obviously if the original cost factor had been correctly determined, the percentage of increase reflected in an end result of $132 million **would be substantially less than 3%.**

"The fact that there has been a substantial inflation has not escaped our attention. 'Judges are not necessarily ignorant in court of what everybody else, and they themselves out of court, are familiar with; and there is no reason why they should pretend to be more ignorant or unobserving than the rest of mankind.' . . . We conclude that the commission misinterpreted and closed its mind to the evidence relating to current value and failed to give any proper weight to the factor in determining the rate base."

Conclusions . . . In its conclusions, the court said, "We do not understand that the company questions the fair rate of return fixed at 5.9% and in any event there was substantial evidence to support the finding. This fair rate of return as has been pointed out must be applied to a fair rate base and one which is determined pursuant to legislative mandate. The rate base here selected not only is artificially reduced by error in the original cost factor patent on the face of the decree, but gives insufficient consideration rather than appreciable reflection to the factor of current value or what might be termed the present well-known economic facts of life. Rates predicated on such error must be reconsidered. The public properly demands service and to fulfill these demands the company must expand. It cannot serve or expand if its financial structure does not attract confidence.

"The uncertainties of the weather and its water resources compel it to have standby steam capacity to guarantee service under all conditions, with resulting unavoidable expense. It must contend with greatly increased costs of materials and labor and an income tax which deprives it of over half of every net dollar. On the other hand, the commission must strike a nice balance between the essential revenue needs of the company and the value of the service to the rate payer and his ability to pay."

Nashville Power Board Buys City Light Plant

The Nashville, Tenn., Power Board has announced the purchase of the city light plant for $215,000.

The transfer will be effective December 1.

The sale means that functions of the city light plant will be assumed by Nashville Electric Service, which is already executing a $17 million street light replacement program. The purchase will give NES responsibility for the old system, as well as the new one being installed.

The purchase price will be applied against the city's cost share of the street-light replacement program.

As a result of the contract, nine employees of the city light plant will

(*Continued on page* 168)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
Oct. 21	**2.85**	**2.90**	**3.09**	**3.86**	**4.00**	**4.36**	**4.57**	**5.00**	**5.30**
Oct. 14	2.88	2.90	3.09	3.87	4.00	4.36	4.55	4.92	5.23
END OF QTR.									
3rd 1954	2.88	2.90	3.10	3.80	3.99	4.38	4.50	4.80	5.19
2nd 1954	2.90	2.96	3.19	4.03	4.14	4.48	4.72	5.04	5.45
1st 1954	2.82	2.87	3.14	3.88	4.09	4.42	4.83	5.19	5.42
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51

Data: Reis & Chandler, Inc.

EARNINGS

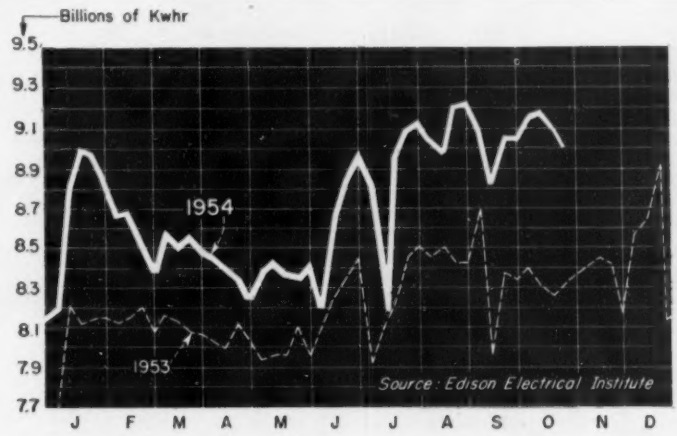
Company	Period Months	Ended	Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Alabama Power	12	Sept.	$13,638,896	$12,573,584	$.....	$.....
Carolina Power & Light	12	Sept.	7,842,850	7,234,152	.....	.....
Central Hudson Gas & Electric	12	Sept.	2,975,458	2,631,317	0.90	0.85
Central Illinois Light	12	Sept.	3,531,515	3,435,027	3.03(a)	3.26(a)
Georgia Power	12	Sept.	13,448,429	12,368,553	.....	.....
Houston Lighting & Power	12	Sept.	12,583,415	10,178,422	2.31	1.96
Iowa Southern Utilities	12	Sept.	1,153,009	1,385,245	1.38(b)	1.98(b)
New York State Electric & Gas	12	Sept.	9,506,851	8,564,655	2.64(c)	2.71(c)
Ohio Edison and subsidiary	12	Sept.	19,877,830	18,485,866	2.95(f)	3.02(f)
San Diego Gas & Electric	12	Aug.	5,321,052	4,509,401	.....	.....
Southern Co. consolidated	12	Sept.	23,253,072	21,738,004	1.28	1.20
Southern Indiana Gas & Electric	12	Sept.	2,334,638	2,138,218	2.10(g)	2.16(g)

Notes—(a) Based on 1,000,000 shares in 1954 and 900,000 shares in 1953; (b) Based on 745,331 shares in 1954 and 627,547 shares in 1953; (c) Based on 3,034,068 shares in 1954 and 2,696,950 shares in 1953; (f) Based on 5,806,136 shares in 1954 and 5,278,306 shares in 1953; and (g) Based on 913,333 shares in 1954 and 799,167 shares in 1953.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF OCTOBER 21-27			
Bonds			
Colorado Springs, Colo—water, electric and power revenues due 1957-82	$10,000	various	1.00-2.35%
Florida Power Corp—1st mtg 3¼% due 1984	12,000	101.07%	3.07
Wisconsin-Michigan Power—1st mtg 3¼% due 1984	3,000	100.75	3.085
Florida Power & Light—1st mtg 3¼% due 1984	10,000	100.877	3.08
Common Stock			
Hawaiian Electric—50,000 sh (being offered commonholders on a 1-for-13 basis, record Sept. 28 to expire Nov. 4; no underwriting)	1,000	$20.00	10.00%
Upper Peninsula Power—30,625 sh (being offered commonholders on a 1-for-8 basis, record Oct. 26 to expire Nov. 10)	674	$22.00	6.36
SCHEDULE FOR NOVEMBER—DECEMBER			Bid Date
Bonds			
Sierra Pacific Power—1st mtg due 1984	$4,000	.....	Nov. 9
New Orleans Public Service—1st mtg due 1984	6,000	.....	Dec. 14
Kansas Power & Light—1st mtg due 1984	8,000	.....	.....
Preferred Stock			
Interstate Power—200,000 sh $50 par	$10,000	.....	Nov. 30
Mississippi Power & Light—44,476 sh $100 par (to be offered in exchange for outstanding $6 pfd on a sh-for-sh basis, plus a cash difference between initial public offering price of new shares and redemption of the old shares)	.....	.....	.....
Common Stock			
Virginia Electric & Power—600,000 sh (to be offered commonholders on 1-for-10 basis, record Nov. 23 with an over subscription privilege)	.....	.....	Nov. 23
ISSUES RECENTLY POSTPONED			
Bonds			
Gulf States Utilities—1st mtg due 1984	$24,000	.....	.....
Consolidated Edison Co of N.Y.—1st mtg due 1984	50,000	.....	.....
Preferred Stock			
Gulf States Utilities—160,000 sh $100 par cum	16,000	.....	.....
UNSCHEDULED AND/OR UNDER CONSIDERATION			
Bonds			
Long Island Lighting—1st mtg	$15,000	.....	.....
Connecticut Light & Power—1st mtg	10,000	.....	.....
Kentucky Utilities—1st mtg	15,000	.....	.....
Kansas City Power & Light—1st mtg	16,000	.....	.....
Preferred Stock			
Black Hills Power & Light—10,000 sh $100 par	$1,000	.....	.....
Central Power & Light—75,000 sh $100 par	7,500	.....	.....
Common Stock			
Kentucky Utilities—about 228,678 sh (to be offered commonholders on about 1-for-10 basis)	.....	.....	.....

STATISTICS



Output Week Ended Oct 23—9,003,000,000 Kwhr

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Oct. 23	+8.8	−0.4	+2.8	+4.5	+4.6	+22.2	+5.0	+0.9	+5.9	+8.2
Oct. 16	+10.3	+2.3	+5.7	+3.6	+7.0	+22.7	+16.9	−2.6	+7.6	+7.8
Oct. 9	+10.7	−0.1	+4.7	+3.2	+7.8	+24.0	+23.0	−2.9	+10.4	+5.7

Seasonally Adjusted Index †172.5 Week Ago 173.9 Year Ago 158.6

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load ‡(Million Kw)	Aug.	79.7	78.2	74.3
Capacity (Million Kw)	Aug.	98.08	96.98	86.63
Production (Billion Kwhr)	Aug.	41.17	40.08	38.53
Hydro	Aug.	8.34	8.76	8.45
Fuel	Aug.	32.82	31.32	30.08
Fuel Consumption:				
Coal (Million Tons)	Aug.	9.83	9.40	9.71
Oil (Million Barrels)	Aug.	4.85	4.45	6.54
Gas (Billion Cu Ft)	Aug.	130.49	127.37	112.88
Sales (Billion Kwhr)	Aug.	33.88	32.99	32.82
Residential	Aug.	9.65	9.50	8.48
Commercial	Aug.	6.66	6.52	5.98
Industrial	Aug.	14.90	14.35	15.83
Other	Aug.	2.68	2.62	2.52
Net Income Class A & B Companies ($ Million)	July	84.44	86.98	73.12
Estimated Dec. '54 Peak ‡(Million Kw)	July	88.1	88.1	91.9
Kwhr per Residential Customer (12 Month Average)	July	2,458	2,441	2,272
Revenue per Kwhr Residential Service (12 Month Average)	July	2.71¢	2.71¢	2.75¢
Canadian Production (Billion Kwhr)	July	5.48	5.67	5.18

Business Statistics

FRB Industrial Production Index†	Sept	126	124	135
Gross National Product Annual Rate ($ Billion)	2nd Qtr.	356.0	355.8	369.9
EW 4 Industry Production Index†	Sept.	117.0	115.4	124.9
ENR Construction Cost Index†	Oct.	134.6	134.3	128.0
BLS Consumer's Price Index	Sept.	114.7	115.0	115.2
NEMA Insulation Materials Sales Index†	Aug.	111	92	153
NEMA Electric Appliance Sales Index†	Aug.	91	88	90
NEMA Household Refrig. Sales Index†	Aug.	71	93	63
Metal Prices (Oct. 26)				
Copper, Conn. V., lb		30¢	29.7¢	29.7¢
Lead, N. Y., lb		15¢	14¾¢	13½¢
Zinc, prime Western E. St. Louis, lb.		11½¢	11½¢	10¢
Tin, Straits, qual. N. Y. lb		93¼¢	93¾¢	80¾¢
Aluminum, ingot, base price		22.2¢	22.2¢	21½¢
Nickel, base price		60¢	60¢	60¢
Steel, billets, Pitts., ton		$64.00	$64.00	$62.00
Steel, scrap, No. 1 heavy, Pitts., ton		32.00	30.00	36.00

*Preliminary **Revised ‡Class 1 Systems †1947-49=100 ††1949=100

Power From Fuels—Coal Still Tops With 2/3 Total

Over 65% of the total power generated from fuels last year ultimately was provided through coal. This was slightly lower from a percentage point of view than what it has been in the past few years — 67½% in 1952; 69% in 1951.

On the other hand, the other major sources, gas and oil, both gained, with gas representing almost 24% of the total generation and oil 11%. As percents of regional generation, East North Central uses more coal, New England more oil, and West South Central more gas, in producing energy for their respective regions. The data is from a recently released report compiled by Edison Electric Institute's Statistical Department.

	Cost per Kwhr	% of Net Generation
COAL		
New England	.48¢	42.6
Middle Atlantic	.39	79.5
East North Central	.33	93.3
West North Central	.42	48.0
South Atlantic	.33	74.1
East South Central	.23	74.6
West South Central	—	0.1
Mountain	.32	23.8
Pacific	*	2.2
Total U. S.	**.35**	**65.1**
OIL		
New England	.47¢	57.2
Middle Atlantic	.44	13.7
East North Central	—	0.1
West North Central	.65	2.6
South Atlantic	.39	14.4
East South Central	—	—
West South Central	—	0.3
Mountain	.34	11.7
Pacific	.37	44.9
Total U. S.	**.42**	**11.1**
GAS		
New England	—	0.2
Middle Atlantic	.39¢	6.8
East North Central	.26	6.6
West North Central	.31	49.4
South Atlantic	.26	11.5
East South Central	.18	25.4
West South Central	.13	99.6
Mountain	.26	64.5
Pacific	.31	52.9
Total U. S.	**.22**	**23.8**

*Fuel not comparable—consists of hogwood and sawdust.

Note: Cost per kwhr omitted where generation is less than 1% of total generation by fuel.

WASHINGTON COMMENT

JESSE MOCK

Everyone in Washington from Supreme Court justices down is accused of operating with one eye cocked toward the election returns. These returns come out in neat rows of figures, but the interpretation of them is likely to depend on who is doing the reading.

Election Returns Are Subject to Interpretation

Thus while the outcome of tomorrow's Congressional elections may have substantial bearing on several pending matters involving federal power policy, no one can foretell the nature of the decisions merely by analyzing the vote counts.

Depends on Viewpoint . . . Public officials have a way of interpreting the results in the light of their own political thinking. For instance, the Eisenhower landslide in 1952 was interpreted by some as a mandate for a radical shift in federal power policy. However, Democrats were quick to note that the Congressional candidate backing federal construction of the Hells Canyon project was elected in Idaho. And Tennessee Democrats displayed a telegram from Candidate Eisenhower promising that the Tennessee Valley Authority would be operated at "maximum efficiency."

Reports reaching Washington indicate that the Administration's federal power policy is the hottest issue in the Oregon senatorial campaign where Democrat Richard Neuberger is trying to unseat veteran Republican Guy Cordon. The Neuberger theme is that the federal government should finance most of the Pacific Northwest power development. Cordon believes local groups should pick up as much of the tab as they can finance. During his years in the Senate, Cordon has managed to get the federal government to appropriate huge sums of money for hydroelectric development in his area.

Now try to read some significance into the outcome of the Cordon-Neuberger contest. If Cordon wins, will it be because Oregon voters fully approve the GOP power policy or because they endorse his successful efforts to gain federal funds for power development? Or will it be because there are simply more Republicans than Democrats in Oregon? If Neuberger wins will it be because the voters fared better under New Deal power policy or because Republicans simply haven't taken the trouble to explain the partnership approach to power development? Or will it be that Neuberger has done more handshaking in the state?

Whatever the outcome may be, you can count on listening to all these interpretations of the election returns from that state.

Confusion or Guidance . . . To confound further the political analyst who attempts to translate the Oregon results into legislative action, private surveys made in that state indicate that only one out of five potential voters has any clear picture as to how the candidates stand on the power issue.

But what may be confusion to the analyst is guidance for the next Congress. For no matter how the elections go in certain states, the party leaders will find evidence to support their previously held views. A Republican-controlled Congress will likely stick closely to Administration power policy although the fate of such a key leader as Cordon could modify legislative action on power measures.

A Democratic majority, on the other hand, can be expected to try to derail the GOP policy with every legislative device available. As pointed out in a previous column (EW, Oct. 18), the legislative means for reversing current policy are limited if President Eisenhower remains determined in his stand.

It may be that public officials do, as the saying goes, keep a sharp eye on the election returns. If so, it appears each has his own key for interpreting them and that no two keys are precisely alike.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Ultrasonic vibrations (28,000 cps) are being used in Britain to descale boilers. The idea originated in Switzerland.

Transient performance of a voltage divider may be measured in terms of the spectrum of steady-state frequencies to which it faithfully responds.

Operation of a machine within its capability becomes the limit for leading power factor operation rather than steady-state stability, particularly under regulator control.

Sheath damage is likely to occur on cables subjected to several handlings and re-reelings, eg cable salvaged for re-use.

Single sideband carrier accepts less noise because the bandwidth is reduced and a lower signal level can be used at the receiving end.

Microwave communication offers a large number of channels on a single radio beam. It is independent of the transmission system and essentially independent of weather conditions.

Lead sheath corrosion by alkalis usually results from contact with uncured concrete containing sodium or calcium hydroxide. Lead monoxide will be indicated by a typical orange or red layer.

Zirconium is as plentiful in the earth's crust as carbon, zircon (zirconium silicate) being found in beach sands.

Water-spray dust collectors will be studied by Bituminous Coal Research, Inc, to reduce emission during soot blowing of commercial and industrial boilers.

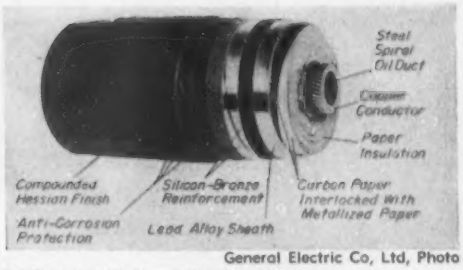
Teflon in tests at the Bureau of Standards had to be heated to 490C (912F) before appreciable decomposition occurred. Polyvinylidenefluoride stood next at 430C.

Galloping of conductors on transmission lines stresses the structures and the hardware far beyond normal.

Lightning arrester grounds are interconnected with substation ground grid and equipment frame by 9 out of 10 utilities.

Alcan pioneers at underground station where . . .

301-KV CABLES FOR KITIMAT HAVE CAPACITY OF 240 MVA



General Electric Co, Ltd, Photo

PIRELLI-GENERAL oil-filled cable for Kitimat

Oil-filled cables, carrying power from the underground generating stations of the Aluminum Co of Canada, Ltd, for the company's Kemano-Kitimat reduction works on the west coast of British Columbia, have a nominal capacity of 240 Mva at 100% daily load factor, highest cable capacity in western hemisphere. Two circuits of three 301-kv, single-core cables, emerge from the 670-yd tunnel at Kemano to tie in with the overhead line to Kitimat 50 miles away. They are charged initially with 287.5 kv.

The invitation to bid for these first two circuits indicated that circuit length was 2,000 ft per phase, maximum difference in elevation 75 ft, nominal circuit voltage 301 kv, impulse level 1,050 kv, and required capacity 550 amp. Of bids received on four different types, the oil-filled cable of that type developed by Emanueli was selected. This type of cable has been in operation at 220 kv in Paris since 1936, and at 33 to 138 kv elsewhere for nearly 30 years. Approximately 3,000 miles of it have been installed, some 140 miles in Canada, with no record of inherent failure.

One circuit, supplied by Pirelli General Cable Works of Southampton, England, is of standard construction, having a copper conductor and reinforced lead sheath. Canada Wire & Cable Co, Ltd, Toronto, supplied the other, which has an aluminum conductor and aluminum sheath, an innovation in extra-high-voltage cable engineering and the first commercial use of an all-aluminum high-voltage cable. It is the first cable having an operating rating over 161 kv designed and manufactured in North America.

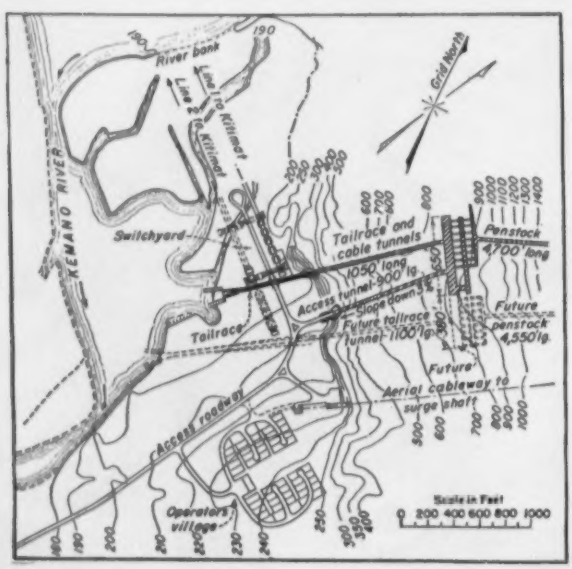
OIL-FILLED CABLE is pulled over aluminum rollers along 670-yd-long tunnel at Kemano from the switchyard end to the transformer chamber

ONE PHASE of Pirelli-General cable is being passed into the transformer vault through the roof of tunnel running parallel to switchyard

OPERATOR cuts chamfer of a stess control on one side of the straight joint. Insulation is built by hand with paper rolls

OIL-FILLED, SINGLE-CORE CABLES ARE RACKED IN KEMANO TUNNEL

Design and Proof Tests . . . These cables were designed and manufactured for a cable system under the following installation conditions: Three single-conductor cables per circuit, each racked in an underground cable tunnel on substantially level profile; one termination in transformer vaults in the underground powerhouse and one in the outdoor switchyard; the cables in the tunnel are racked in a flat array with the three cables of each circuit in one horizontal plane of sufficient separation to eliminate mutual heating, and the horizontal spacing between cable centers is greater than 8 in. and vertical spacing between cable centers greater than 12 in. Sheaths of all cables are bonded and grounded at center of each circuit length only so that the sheaths are open-circuited at each end and no sheath circuit currents can flow (The cable sheaths are insulated from supporting racks by hardwood insulator clamps, and the terminals are on insulated mountings of a minimum dry flashover rating of 30 kv rms); and the cables are designed for ambient air temperature of 40C maximum, and 0C minimum, and a conductor temperature rise of 45C maximum.

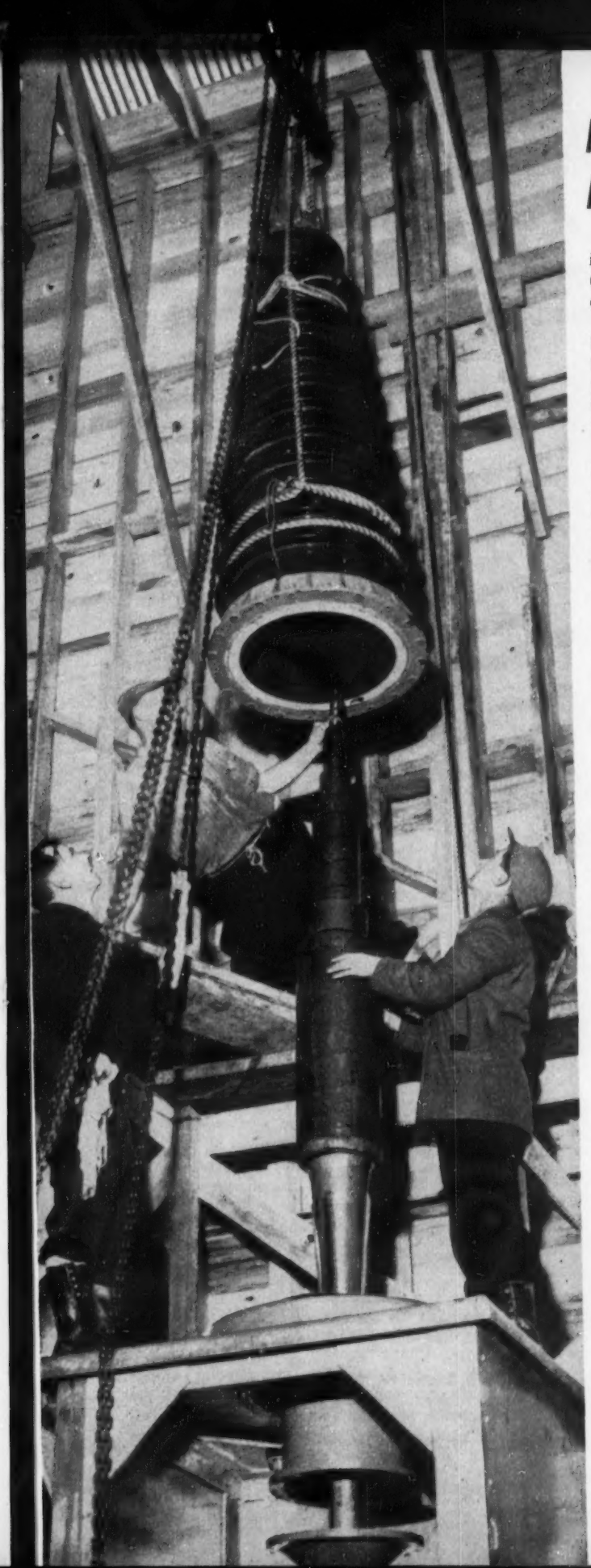


Both cable types were subjected to design proof tests for impulse characteristcis, ten positive and ten negative impulses of 1,050 kv, 1½ x 40-microsec wave and for 60-psi high-voltage performance, 350 kv to ground for 24 hr, followed by 425 kv for two hours.

These tests were made on a cable sample containing a joint and two terminations. Samples were previously subjected to a bend test of four 360-deg bends on a radius of 6 ft in each of two planes 180 deg apart for a total of eight bends which required that each sample be straightened eight times.

Pirelli Cable

When Pirelli-General received the Alcan inquiries, few cables had been constructed nor any installed anywhere except Sweden for voltages in the order of 300 kv. The high capacity demanded of the cable required considerable development work before installation. Only a very highly stressed insulation could keep dimensions and costs within reasonable limits. Previous experience with oil-filled cables



ALCAN PLANT INSTALLS LEAD, AL SHEATH LINKS TO OVERHEAD

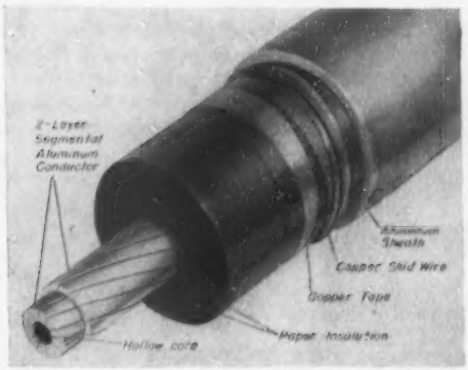
indicated that a maximum working stress of 305 v per mil (120 kv per cm) would be feasible, provided a dielectric of nearly perfect quality could be ensured.

Wrinkling and creasing of insulating papers, particularly with increased insulation thickness, had to be avoided because of their effects on dielectric strength under impulses. A formula was developed for estimating exact tensions at which papers in all layers were to be applied to insure satisfactory operation of the cable.

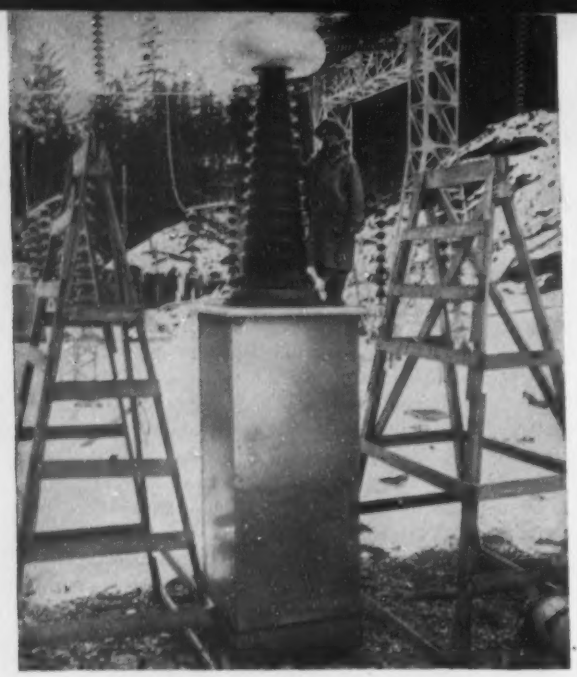
Drying and impregnating insulation were other preliminary considerations. The larger mass of paper required a much longer drying period. To assure a high degree of dryness prior to lead sheathing, the cable was provided with an outer screen of semi-conducting carbon paper interlocked with metallized paper. These papers present a less impermeable barrier to drying than metal or metallized paper screening.

The outer end of the cable run between the tunnel's mouth and the overhead line is exposed to extremely low temperatures. In winter the viscosity of the grade of oil normally used for cable impregnation would handicap the hydraulic design of the installation. Accordingly, an oil of about a third of the normal oil's viscosity was used. Its electrical performance matches that of the ordinary oil. New drying and impregnating tanks were required for the 12-ft diameter drums on which the cable is wound. The cable is supplied in lengths of approximately 230 yd and has an overall diameter of 3.83 in.

Tests . . . A cable specimen was given an 85C load cycle test at 323 kv to earth, besides the tests specified above, including bending around a 120-in. diameter drum. These tests indicated that cable and accessories had a margin of safety over impulse voltages up to 1,240 kv and ac voltages up to 500 kv without reaching breakdown. Tests at elevated conductor temperatures were also made. On ac, a joint failed at 425 kv after the conductor temperature had been held at 100 to 105C for 10 hr. Under impulses with the whole assembly externally heated to 84C, a joint failed at 1,100 kv.



INSULATOR, left, is lowered over the end of the insulated cable. Cutaway, above, shows the make-up of Canada Wire's aluminum cable



SIZE of three Pirelli-General 301-kv, oil-filled cable sealing ends is made apparent by this comparison with one of project's workers

Installation . . . The cable was installed by pulling it along the tunnel from the outdoor switchyard end. Pulling the middle and innermost lengths required removal of the cable from the drums and use of mobile pressure tanks which were taken along the tunnel continuously connected to the cable.

This tunnel, blasted out of solid granite, slopes from the underground transformer chamber to the outdoor switchyard, and there is a 36-ft difference in level between its ends. The powerhouse is inside a mountain, and the switchyard at the terminal point of the overhead line is on level ground at the toe of the mountain. At its innermost point, the tunnel is 2,600 ft below the surface.

The cables are supported in wooden cleats in horizontal formation at 12-in. spacing between phases. They are clamped at 5-ft intervals and supported every 15 in. An initial vertical deflection of ⅜ in. in the center of each 5-ft cable span controls expansion under load.

Oil Feeding System . . . Oil pressure tanks are of standard internal cell design. Two tanks, each containing 225 liters (7.95 cu ft) of air pre-pressurized to 7½ psi, are connected to each cable. These pressure tanks are in the transformer chamber at the upper end of the tunnel.

The hydraulic design must operate in ambient temperature varying between 120 and −10F, and the cable must withstand sudden application of full load at an extremely low temperature. The oil's low viscosity largely obviates difficulties, and the maximum transient pressure rise at any point in the cable cannot exceed 40 psi. This value is below the maximum static pressure which is 50 psi in the cable and 44 psi in the lower sealing end. Oil leakage is spotted by a triple-unit, differential, oil-pressure-indicating switch in the transformer chambers, cross-connected in the usual way, and visual oil-pressure gauges are also fitted.

Joints and Sealing Ends . . . Joint design follows oil-filled cable principles. By obtaining the cable in lengths of approximately 230 yd, the joints are limited to two per phase, a total of six. Total length and profile of the tunnel eliminate stop joints. The joints were built up by hand with paper tube rolls and encased in mild steel sleeves having mechanical joints between the cylindrical sleeves and the phosphor-bronze end bells plumbed to the cable sheaths.

The same type of sealing end is used for the underground transformer chambers and external overhead connections. The design is conventional, no condenser-type stress control being employed.

Cable ends, insulated in the horizontal position and placed in specially designed splints, were raised through 90 degree to an upright position, the splints removed, and the porcelains lowered on to the ends. The completed sealing ends are mounted on structures which also support split-ring type current transformers fitted over the cables after the sealing ends were made. The sealing end bases are insulated from the structure. Cable sheaths are earthed only at the center of the run.

Canadian Cable

Canada Wire & Cable Co's cable has a conductor cross-section more than ample for load current requirements, and the conductor is aluminum to obtain the low catalytic effect of aluminum on impregnating oils and compounds; a considerable reduction in overall cable weight; and a possibly smoother conductor surface owing to the comparatively greater ductility of aluminum. It is composed of two layers of aluminum elements, 12 per layer, laid in the hollow core segmental construction common to all designs of Canadian oil-filled cable. Omission of a core-supporting member increases oil flow, permitting a smaller oil channel and further justifying the use of a lower-conductivity metal. Furthermore, the smoother the conductor surface, the greater is the improvement in overall electrical qualities of the design and the more effective are the auxiliary conductor shielding tapes.

Insulation . . . The insulant structure consists of high-grade wood-pulp paper, with a specific layer next to the conductor of 0.0025-in. thick tapes and the remainder of 0.005-in. tapes. Owing to the insulant wall thickness, a special taping pattern and large-diameter reels had to be used at all stages of manufacture. A drum diameter of not less than 120 in. was used.

A special impregnating oil, having a viscosity as low as 31 centistokes at 0C and 4.4 centistokes at 50C, and high gas absorption, was used. The design incorporates a "skid wire" for facile removal of the aluminum sheath. The seamless aluminum sheathing, reducing the finished cable weight by nearly 45%, was applied by the swaging process, and drying and impregnating of the cable were in accordance with conventional North American practice.

Joints and Terminals . . . The joints are of the fully shielded type, employing flush ferrules, and designed for operation at full voltage rating of the cable system. It has long-time voltage breakdown and impulse voltage breakdown strengths commensurate with those of the cable. The ferrule was fully compressed on to the conductor in the usual way after the outer layer of segments

(*Continued on page* 168)

Air Conditioning Peak Seen in 1963

Off now to an impressive start, cooling devices are becoming a major component of electric utility load with a probable annual energy requirement reaching 55-billion kwhr or more, trends indicate

J. R. HERTZLER, Vice-President, York Corp, York, Pa.*

By 1963 the connected load of air conditioning may well be in excess of 55 million kw and the annual energy requirement 55 billion kwhr or more. These are not definite figures, but they are the results of rather exhaustive study of data now available considered in the light of industry predictions and presently discernible trends. Thus the figures do have a certain validity and should be useful as at least indicating the potential of air conditioning load.

The over-all picture is shown in Table I and its associated graph and text. Tables II and III present the numerous factors that enter into consideration of the air conditioning market potential.

Measure of Summer Discomfort. . . In the magazine, "Heating, Piping and Air Conditioning," May, June, and July, 1953, there appeared an analysis of summer weather data by which a series of summer climatic factors were calculated for each of the counties of the United States. The purpose of this analysis was to prepare criteria which could measure both the intensity and the duration of summer discomfort in a manner similar to the degree-day method of calculating heating equipment distribution and annual fuel consumption.

The summer climatic factors calculated were tabulated in relation to the summer discomfort of Florida, which from the studies was proved to have the greatest ratio of summer discomfort of all the states in the United States. These summer climatic factors were in turn applied to correct retail sales distribution for each of the trading areas so that an effective measure of air conditioning sales potential could be obtained. Retail sales had been found to represent a good index for the distribution of commercial air conditioning which was the first important comfort application in the country. Theatres, stores, restaurants, and office buildings first used comfort air conditioning extensively; however, of greater significance at present is the development of the market for year-round air conditioning for comfort in the home.

Retail Sales a Factor. . . Sales experience in the distribution of room air conditioners sold by appliance merchandising methods has supported the use of retail sales as a yardstick for distribution of this product. In order to measure accurately the potential for the sale of year-round residential air conditioning systems, it is believed that other base criteria can be developed from the wealth of information available through the Bureau of Census "1950 Census of Housing." Some recommendations in this regard are expected to be published in "The American Artisan" later this year.

In this article retail sales corrected for summer climatic factor are used as a yardstick to predict the proportionate shares of the rapidly developing room air conditioner and year-round residential air conditioning market which geographical areas and territories will receive.

Tables II and III present significant background data for analyzing the future growth potential of residential air conditioning, particularly the central plant type for cooling the whole house as compared to the room air conditioner type. These tabulations, also Table I, do not in any way anticipate a broad-scale use of the heat pump principle for space heating in residential systems. In 1953, there were fewer than 1,000 central plant heat pumps sold for all uses, despite the advantages it offers in areas of low heating climatic factor.

Summer Cooling the Determinant. . . The heat pump principle has been effectively applied to room air conditioners to make it possible to use this summer cooling device for supplementary and selective air tempering, particularly in spring and fall. Since the room air conditioner is an air-cooled device, it is easily convertible to reverse-cycle operation to use outside air as a heat source and, theoretically, above 18 F, it has greater Btu heating capability per kilowatt input than can be secured through the use of electric resistance heating.

In central plant heat pump systems, there is a tendency, particularly in colder climates, to supplement the unit as installed for summer cooling with electric resistance heating rather than utilize the reverse cycle for the total heating load, which may be of very short duration at maximum heating demand. The diversity factor with other electric appliances has indicated that electric resistance supplementary heating applied to a heat pump system is not as unfavorable from the utility standpoint as originally expected As first cost is one of the disadvantages of a central heat pump year-round system, this increased first cost can be reduced somewhat by the use of electrical resistance heating to supplement the compressor capacity required for maximum summer cooling load.

Heating Will Increase Load. . . The annual energy consumptions indicated here would be increased if there were broad-scale usage of the heat pump principle and extended periods of operation of summer air conditioning equipment for spring and fall or winter heating duty.

Similarly, no significant recognition has been given in evaluating potential electric power loads to systems which might use gas or other sources of energy for summer cooling. Even with absorption systems or other systems using gas for energy, some electricity will be required for

* Since preparing this article, Mr. Hertzler has left York Corp and is now engaged in consulting practice.

the operation of auxiliaries for circulating the air within the conditioned space and for getting rid of the heat which is removed from it. Whether accomplished by an air-cooled condenser or through the use of water in a cooling tower system, the horse-power of the auxiliaries and the annual kilowatt-hour consumption represent a significant load as applied to residential air conditioning year-round.

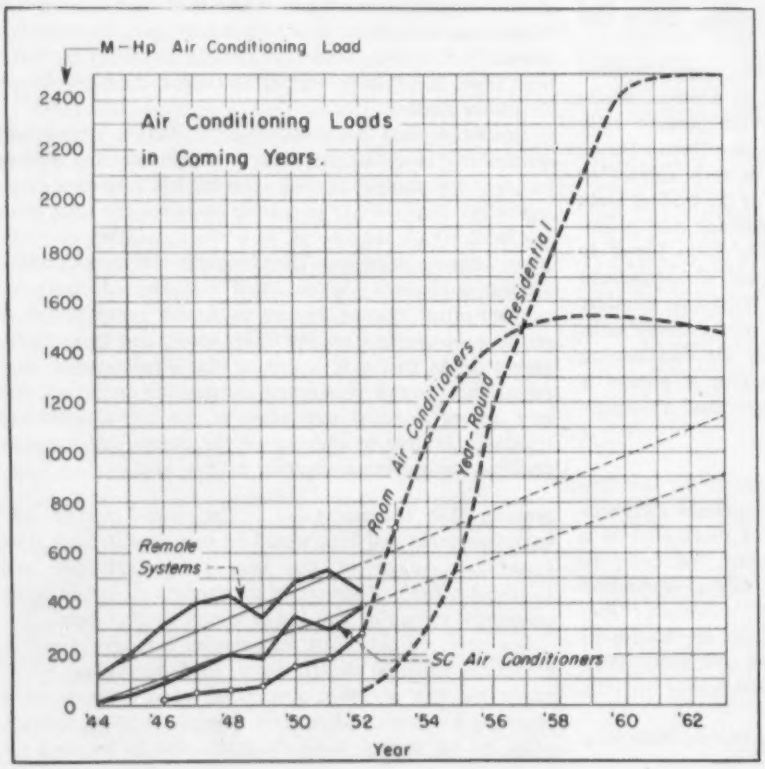
Acceptance of Packaged Units...The comments and estimates here presented result from a thorough-going analysis of past performance of the postwar years, particularly the Bureau of Census "Facts for Industry" reports covering manufacturers' shipments of refrigeration and air conditioning equipment. Air conditioning sales are inseparably reported with refrigeration sales; consequently it is only by estimating and by making assumptions that the air conditioning load itself can be isolated. It is important to note, however, the significant size of the packaged air conditioner business and the increased acceptance of self-contioned room air conditioners and year-round residentail systems.

It should be the privilege and prerogative of forecasters to review, refine and recalculate projections such as those made here. It is possible that some additional factors can be injected which would make the criteria more accurate for predicting future growth. Particularly do we believe that it will be possible to refine the information with respect to single family detached dwelling units in separate structures and to analyze further the conversion of wet heat systems to year-round residential air conditioning systems in such a way as to predict this market more accurately.

Better Estimates Later...It is also possible that while annual sales predictions may not be met, the ultimate use of air conditioning equipment will be predicted on a broader scale as saturation increases. It has been generally accepted that the present saturation level on air conditioning for comfort is less than 5% in the various classes of systems. With such a low saturation point, there is time to refine the yardsticks by which future growth rates may be predicted year by year. No one can write a finished book on this subject until the American public has an opportunity to express itself as to preference and until the various manufacturers and distribution specialists have had a chance to test theories and influence public opinion toward the ultimate type of system to be preferred by the majority of people.

There will always be a market for the room air conditioner just as there will be a distinct preference for the year-round residential system for heating and cooling. It is the hope of the air conditioning equipment manufacturers that when and as the markets are developed for comfort air conditioning in the home, the electric utility industry will be in a position to provide the service.

Air Conditioning Load Is Soaring



Taking one horsepower of air conditioning as equivalent to one kilowatt of connected load, Table I indicates that such load is now of the order of 10 million kw and will probably be over 55 million in 1963.

Data for the table and graph through 1952 were calculated from Bureau of Census "Facts for Industry" reports of manufacturers' shipments, including the horsepower required for the operation of auxiliaries including water-circulating pumps, cooling tower fans, evaporative condenser fans and pumps, and other miscellaneous auxiliaries as required for such systems, both steam driven as well as electrically operated. The figures for remote systems were evaluated on the basis that 60% of the shipments were for air conditioning duty and 40% for refrigeration.

Except for year-round residential systems—used also for heating—the figures for the years ahead are graph projections based on growth through 1953 and modified, in the case of room air conditioners, by industry opinion.

Table I—Growth of Air Conditioning Loads Actual through 1952. Projected through 1963

Year	Cumulative from 1944	Total Hp Added Each Year	Hp Remote Systems	Hp SC Air Condrs	Hp Room Air Condrs	Hp Year-Round Residential
1944	.....	115,725	100,928	14,797	.....	.....
1945	.....	240,002	198,582	40,450	970	.....
1946	.....	438,385	324,175	88,610	25,600	.....
1947	.....	592,748	403,238	152,610	36,900	.....
1948	.....	694,583	431,543	202,590	60,450	.....
1949	.....	609,154	341,509	195,015	72,630	.....
1950	.....	994,059	494,589	343,395	156,075	.....
1951	.....	1,005,064	532,774	291,880	180,410	.....
1952	5,877,750	1,188,030	458,185	383,745	294,200	51,900
1953	7,757,750	1,880,000	600,000	430,000	700,000	150,000
1954	10,232,750	2,475,000	655,000	470,000	1,050,000	300,000
1955	13,337,750	3,105,000	710,000	520,000	1,275,000	600,000
1956	17,492,750	4,155,000	760,000	570,000	1,425,000	1,200,000
1957	21,922,750	4,430,000	815,000	615,000	1,500,000	1,500,000
1958	26,787,750	4,865,000	870,000	670,000	1,525,000	1,800,000
1959	32,047,750	5,260,000	925,000	710,000	1,525,000	2,100,000
1960	37,682,750	5,635,000	980,000	760,000	1,525,000	2,370,000
1961	43,492,750	5,810,000	1,030,000	810,000	1,520,000	2,450,000
1962	49,447,750	5,955,000	1,090,000	855,000	1,510,000	2,500,000
1963	55,477,750	6,030,000	1,145,000	905,000	1,480,000	2,500,000

The data show that in 1952, including the horsepower for remote systems, self-contained air conditioners, room air conditioners, and year-round residential systems with auxiliaries, there was an added load of 1,188,000 hp.

In the nine years, 1944 through 1952, the total cumulative horsepower installed for air conditioning duty, postwar, amounted to about 5,878,000 hp. Compared with this is the estimate, evaluated from predictions, of 6 million hp added in one year, which is reached in the 1962-63 period.

Also, it is of some significance to note that by the end of 1957, the air conditioning installed since 1944 could equal almost 22 million hp which would be about 375% of the air conditioning installed postwar and in use at the end of 1952. And in the ten years, 1953 through 1962, the cumulative air conditioning horsepower load could reach a total of about 49,500,000 hp which would represent almost 850% of the postwar installed horsepower placed in operation from 1944 through 1952.

General economic factors including population growth, the formation of family units, and indicates of disposable income, retail sales, etc—treated in detail in following tables—would seem to support a continued growth of both remote systems and self-contained air conditioner systems, 2 hp and larger, as indicated on graph.

In the case of remote systems, the projection to 1957 would indicate a growth to about 815,000 hp for air conditioning including auxiliaries as compared to 1952's 458,000 hp, an increase of 80% in the five-year period or an average of 16% increase per year.

Similarly, in the case of self-contained air conditioners, 2 hp and larger, the projection of the growth rate which was experienced to 1952, would indicate 615,000 hp in 1957 as compared to 384,000 hp in 1952, or a 60% increase over a five-year period, an average of 12% increase per year.

In the case of room air conditioners the graph contemplates an increase to an annual rate of about 2 million unit sales per year, which would level off in 1957, at about 1,500,000 hp.

There have been many estimates of the future room air conditioner sales rate, many of which have been above the 2 million annual rate, some below. Electrical Merchandising has prepared valuable studies of room air conditioner sales, both as to season and quantity. The Sept. 21, 1953, Electrical Industry Forecast of Electrical World, contained a prediction which showed an annual sales rate of room air conditioners of about 1.7 million units in 1963.

In 1957 it appears that the electric load of year-round residential systems of, say, 500,000 at 3 hp average each, would approximately equal the electric load to 2 million room air conditioners.

Until a more complete analysis of the total market for room air conditioners and residential systems is developed, the period of saturation as indicated by the knee of the curve, cannot be definitely calculated. There will apparently be a similar leveling off in the sale of year-round residential systems in 1961 and 1962 in line with many of the current predictions of the experts within the industry.

It has not been the purpose of this discussion to predict definite values but rather to indicate the trends as they are being experienced in the development of residential air conditioning of all types and to evaluate the electric load if some of the predictions with respect to the market are realized.

Table II—Regional Distribution of Air Conditioning Market and Electricity Requirement Potentials

Census Region	(1) % U.S.A. Population Jan. 1, 1953	(2) % U.S.A. Disposable Income 1952	(3) % U.S.A. 1952 Retail Sales	(4) % U.S.A. Index	(5) % U.S.A. Air Cond. Potential	(6) % U.S.A. 5 Year Elec. Energy Sales–Residences	(7) M. Kwhr. Energy Requirement 2 Million RAC	(8) M. Kwhr. Energy Requirement ½ Million Resid. AC System	(9) Total M. Kwhr. Energy Requirement RAC & Resid. Per Year	(10) Cooling Climatic Factor	(11) Heating Climatic Factor
New England	6.05	6.60	6.43	6.44	4.37	5.37	87,400	65,550	152,950	.346	.690
Middle Atlantic	19.73	22.65	21.41	21.69	20.29	16.71	405,800	304,350	710,160	.484	.603
E N Central	20.06	22.39	21.76	21.73	19.04	21.75	380,800	285,600	666,400	.447	.663
W N Central	9.18	8.63	9.79	9.09	9.91	9.13	198,200	148,650	346,850	.517	.670
S Atlantic	14.24	11.41	11.57	12.03	18.98	12.23	379,600	284,700	664,300	.840	.343
E S Central	7.46	4.84	4.99	5.40	8.06	6.95	161,200	120,900	282,100	.825	.345
W S Central	9.74	8.30	8.93	8.78	15.04	6.33	300,800	225,600	526,400	.861	.265
Mountain	3.47	3.37	3.65	3.48	1.04	4.41	20,800	15,600	36,400	.147	.571
Pacific	10.07	11.81	11.47	11.36	3.27	17.07	65,400	49,050	114,450	.146	.311
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	2,000,000	1,500,000	3,500,000	.509	.521

Some Regions Provide a Better Market

In this table is a general summarization of basic facts tabulated by census regions which have proved to be useful in determining relative market potentials of territories or trading areas. Columns 1, 2, 3 show respectively for each of the regions shares of national population, 1952 disposable incomes of individuals, and 1952 national retail sales.

Column 4 is a calculated index as made by Sales Management magazine weighting population twice, disposable income five times, and retail sales three times.

Column 5 is the per cent of the national air conditioning potential for each of the regions compiled by correcting retail sales distribution of column 3 by summer climatic factor as tabulated in column 10.

Column 6 is the distribution regionally of national electric energy sales for residential service for 1948-'52.

Column 7 is the electric energy requirement calculated to be added each year in thousands of kilowatt hours by an annual sale of two million room air conditioners. This is based on the arbitrary assumption of 1,000 hours operation of the average room air conditioner. Sizes of room air conditioners are various and their operating periods will vary with climate, also with room occupants inasmuch as the units are normally hand-controlled, not usually automatically or thermostatically controlled. The 1,000-hour period at one kw per unit is for comparison only and can be corrected from experience as usage of room air conditioners increases.

Column 8 is a tabulation of the energy requirement added each year by the installation of 500,000 year-round residential systems. This is based on 1,000 hours operation and an average 3-kw load per system.

Column 9 contains the totals of columns 7 and 8.

Column 10 is the cooling climatic factor as developed to measure intensity and duration of summer discomfort as compared to Florida.

Column 11 is the heating climatic factor, which is each region's comparative annual degree-days as compared with the coldest state or the state with the greatest heating requirement, North Dakota.

By way of general comment on Table II, it is significant to note that residential power sales did not in the five years, 1948-1952, follow in all cases the distribution of disposal income. Comparison of columns 6 and 2 shows wide variations, for instance, in the Middle Atlantic region, which has 22.65% of the nation's disposable income as compared to only 16.71% of its electric sales to residences.

The East South Central area comprised of Alabama, Kentucky, Mississippi, and Tennessee with only 4.84% of the 1952 disposable income, accounted for 6.95% of the electrical energy sales for use in residences. Also, the Pacific region with 11.81% of the disposable income accounted for 17.07% of home energy sales.

The effect of climate on the concentration of new air conditioning load is also demonstrated to a marked degree by a comparison of column 5, the "Percent of National Air Conditioning Potential," and column 9, the "Added Air Conditioning Electricity Requirement per Year," for each region with the expected share that might be indicated by the index in column 4.

For instance, the West South Central region comprised of Arkansas, Louisiana, Oklahoma, and Texas, would receive 15.04% of the annual added 3.5-billion kwhr of two million room air conditioners and 500,000 residential systems; whereas its share of the national potential is only 8.78%.

It is to be noted, however, that the average or temperate climates of the Middle Atlantic and East North Central regions account for sizable added loads in each of these areas 710,150,000 kwhr per year in the Middle Atlantic region, and 666,400,000 kwhr in the East North Central region. The South Atlantic region—with a high cooling climatic factor—would be expected to have approximately 19% of the nation's air conditioning sales potential against an approximate index of 12% of the nation. This would result in an added energy requirement of room air conditioners and residential systems of over 664 million kwhr per year in the South Atlantic states.

Dwellings and Dwellers Both Count

The definition of a dwelling unit as developed by the Bureau of the Census becomes very significant when one attempts to evaluate growth of air conditioning. It has one value in relation to potential sales of electric ranges, water heaters, and other appliances that are customarily installed one per family unit but quite another in respect to air conditioning sales. This is apparent from the definition:

"Ordinarily a dwelling unit is a house, an apartment, or a flat. A dwelling unit may be located in a structure devoted to business or other non-residential use. A group of rooms occupied or intended for occupancy as separate living quarters is a dwelling unit if it has separate cooking equipment, or a separate entrance. A single room occupied or intended for occupancy as separate living quarters is a dwelling unit if it has separate cooking equipment or if it constitutes the only living quarters in the structure. Each apartment in a regular apartment house is a dwelling unit even though it may not have separate cooking equipment. Apartments in residential hotels are dwelling unit if they have separate cooking equipment or have two rooms or more."

There were in 1950 a total of 45,983,000 dwelling units (column 1) of which 39,625,000 were urban and rural non-farm dwelling units (column 3). The total of 21,191,000 dwelling units for which central heating data were given shows that only 50.4% of the nation's dwelling units had this amenity. This would be of great significance in evaluating the year-round residential air conditioning system market and justifies going beyond the census definition.

It will be noted that for the various regions, 79.4% of the dwelling units have central heating in the Middle Atlantic region; whereas in the East South Central region only 16.6% have central heating, and the West South Central portion of the country, only 12.5% have central heating. This wide variation also has a bearing on the potential for the sale of year-round residential air conditioning systems. Columns 8 and 10 indicate that warm air systems, gravity and forced circulation types, outnumber wet heat systems to the proportion of 11,301,000 versus 9,890,000.

Column 12 is of assistance in measuring the potential for year-round residential air conditioning system sales in that it separates single family dwellings from all dwelling units, deleting the apartments and other dwelling units that are not in separate or detached structures. Thus, of almost 46,000,000 dwelling units in the United States, there are 29,116,000 single family dwelling units in separate or detached structures. American Artisan magazine has published a copyrighted report on "The Residential Heating Market," which has a very valuable subdivision of census information for the types of heating systems installed in the various states of the United States and the various regions classified as to single-family structure and other than single-family structure, and for fuels, whether coal, oil, or gas fired in central systems.

Comparisons of column 1 of Table II and column 2 of Table III indicate that the distribution of dwelling units by region closely parallels the population by region.

The dwelling units with central heating, however, as evidenced by column 7, vary considerably from each region's share of the total dwelling units. The Middle Atlantic region, for instance, has 31.83% of the nation's dwelling units with central heat as compared to 19.94% of its total dwelling units. Also, the East South Central region has only 2.3% of the nation's dwelling units with central heating even though it has 6.94% of its total dwelling units.

Columns 9 and 11 show the distinct preferences of various regions for warm air heating or for wet heat systems. The Middle Atlantic region has a distinct preference for wet heat systems having about 48% of the nation's total even though it has only 31.83% of the nation's dwelling units with central heating. From column 9 the East North Central region, comprised of Illinois, Indiana, Michigan, Ohio, and Wisconsin, has almost 35% of the nation's warm air heating systems, but only 27% of the dwelling units with central heating.

Table III—Distribution of Dwelling Units by Regions and Kind of Heating System

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Census Region	Dwelling Units Thousands	%	Urban & Rural Non-Farm Units Thousands	%	No. M Dwelling Units With Central Heat	%	% U.S.A. Dwelling Units With Central Heat	No. M Warm Air Systems	% U.S.A. Warm Air	No. M Wet Heat Systems	% U.S.A. Wet Heat Systems	M— Single Family Dwellings	% U.S.A. Single Family Dwellings
New England	2,879	6.26	2,757	6.95	1,704	65.9	8.04	480	4.25	1,233	12.36	1,358	4.66
Middle Atlantic	9,172	19.94	8,770	22.14	6,745	79.4	31.83	2,001	17.70	4,745	47.98	3,566	12.25
E N Central	9,334	20.30	8,269	20.86	5,714	65.6	26.96	3,939	34.85	1,776	17.95	5,984	20.55
W N Central	4,411	9.59	3,325	8.39	2,089	51.3	9.86	1,543	13.66	546	5.52	3,292	11.31
S Atlantic	5,996	13.04	4,875	12.21	1,477	27.2	6.97	645	5.71	832	8.41	4,202	14.43
E S Central	3,195	6.94	2,182	5.51	487	16.6	2.30	358	3.17	128	1.30	2,547	8.75
W S Central	4,462	9.72	3,525	8.89	492	12.5	2.32	341	3.01	152	1.53	3,539	12.15
Mountain	1,608	3.50	1,353	3.41	548	38.8	2.59	428	3.79	120	1.22	1,192	4.09
Pacific	4,924	10.71	4,570	11.54	1,934	43.2	9.13	1,566	13.86	369	3.73	3,436	11.81
TOTAL U.S.A.	45,983	100.00	39,625	100.00	21,191	50.4	100.00	11,301	100.00	9,890	100.00	29,116	100.00

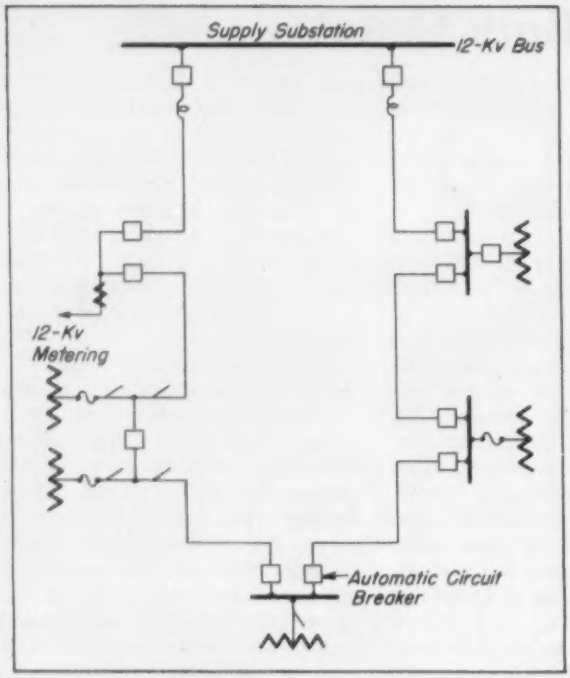
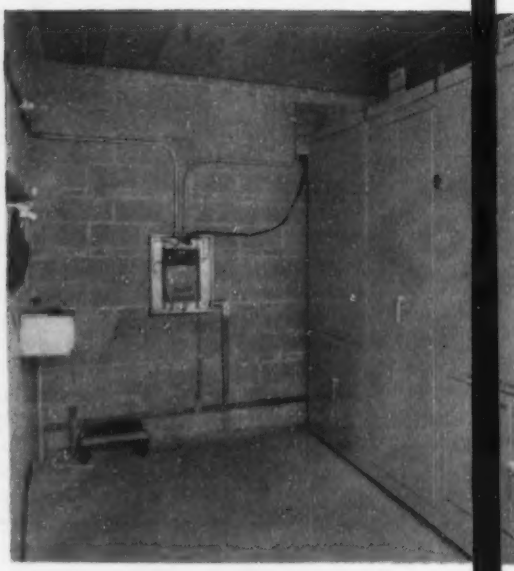


FIG 1—LOOP SYSTEM at 12 kv has, for many years, provided excellent service to large industrial customers in Chicago at low cost



12-Kv Switching Scheme Supplies

N. G. LARSON, Distribution Planning Engineer, Commonwealth Edison Co, Chicago, Ill.

A load-break disconnect-type switching scheme is being used to serve small industrial customers, having loads below 2,000 kva, from the 12-kv system. Commonwealth Edison Co's experience since 1952 shows that the scheme provides reliable service at less cost than the 12-kv loop system and relieves the 4-kv general distribution system.

Large customers in Chicago for many years have been served from the so-called 12-kv industrial loop system. This consists typically of 500-MCM underground cables looped into each customer's electric service station through circuit breakers relayed to switch out a faulty loop section, Fig. 1.

Because of the heavy loads and the use of an underground system, interrupting duties on the circuit breakers have ranged from 150,000 to 500,000 kva. This has required relatively costly switchgear.

The loop system has provided excellent service at a cost which has been reasonable for loads of 2,000 kw or more.

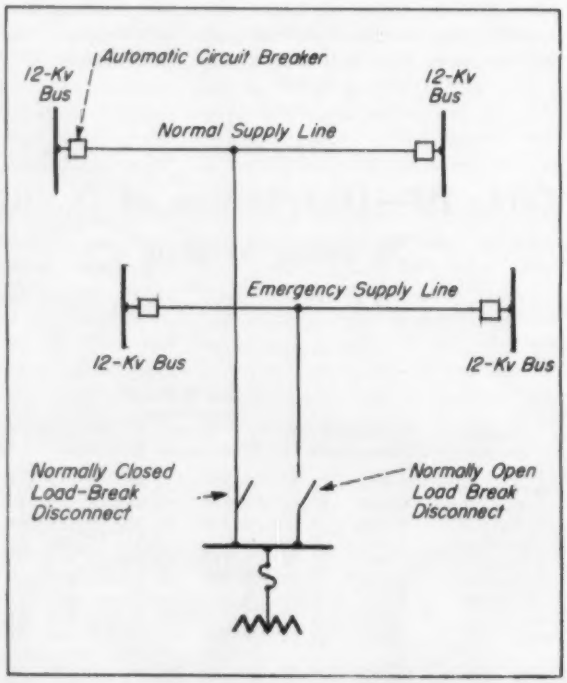
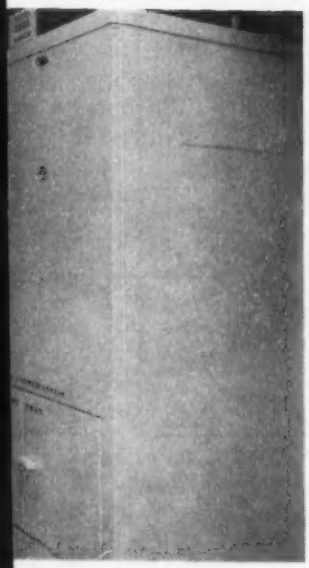


FIG 2—NEW SWITCHING SCHEME has two load-break disconnects that can be connected for manual or automatic throwover. No high-interrupting capacity breakers are needed



DISCONNECT EQUIPMENT is designed for load-break operation under normal conditions. Equipment has no fault interrupting capacity

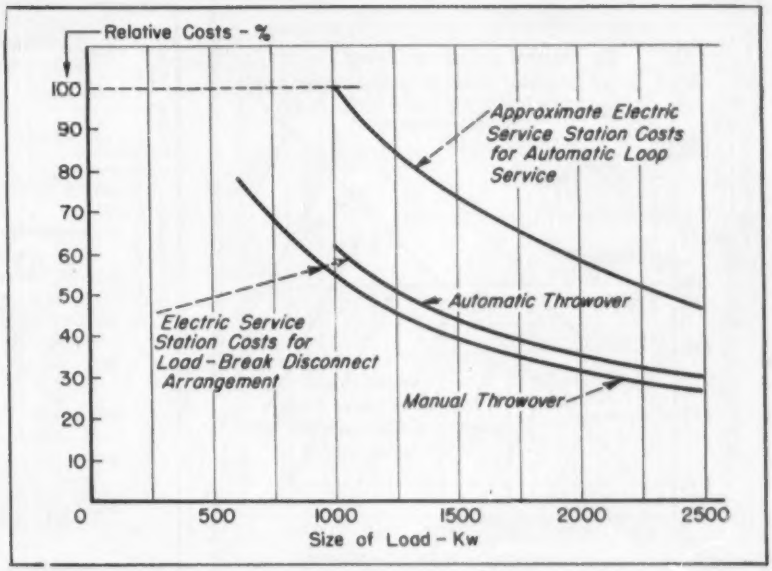


FIG 3—SERVICE STATION COST comparison shows advantage of using the new switching scheme instead of the industrial loop requiring breakers of high short circuit capacity

Small Industrial Loads Economically

However, it is somewhat expensive for the lower loads and prohibitive for loads below about 1,000 kw.

Loads that are too small for economical supply at 12 kv have been served from the 4-kv, radial, general distribution system. In case of a failure of an underground 4-kv feeder, customers or groups of customers have been dependent on manual throwover by outside trouble-men for emergency supply.

For Smaller Customers . . . To provide essentially the same, or better, service for smaller customers and to take advantage of the inherent economy of 12-kv supply, a simplified load-break disconnect type of switching has been used. With the disconnect gear, two independent lines are tapped into each electric service station, Fig 2. One switch is normally open, and that line is available for reserve. Throwover between lines may be either manual or automatic.

Disconnect equipment used, Fig 3, has a normal current carrying capacity of 600 amp at 12 kv and is designed for normal "load break" operation without fault interrupting capacity. Therefore, routine load transfer can be handled without customer interruptions. Likewise, if the normal supply fails, the emergency supply may be connected without customer participations.

Load-break feature makes automatic throwover possible where required. The throwover device is a spring-operated mechanism actuated by a no-voltage release on the "normal" line. Return to the normal line is by manual operation. The device has simple and positive action and operated correctly in the only two cases of line failure to which it has been subjected.

Compare Economics . . . Chicago is well covered by 12-kv lines. Therefore, two lines are generally available and can be tapped at no greater line cost than for a loop-type connection. Thus, economy of the new scheme over the older system is reflected by comparison of electric service station investment, Fig. 3. Comparison in all cases is based on the installed cost of factory-assembled metal-clad switchgear and one 3-phase transformer. Because of the simplicity of the load-break disconnect gear additional savings will result from reduced maintenance costs.

Economy of the new scheme is greater for the smaller loads. Thus, by lowering the load value at which 12-kv service can be justified, the scheme relieves 4-kv capacity for serving normal distribution loads.

As only 11 installations have been made since May, 1952, further experience is required to evaluate fully the operation of the new arrangement. However, no important limitations or defects have developed, and additional installations are being made as required.

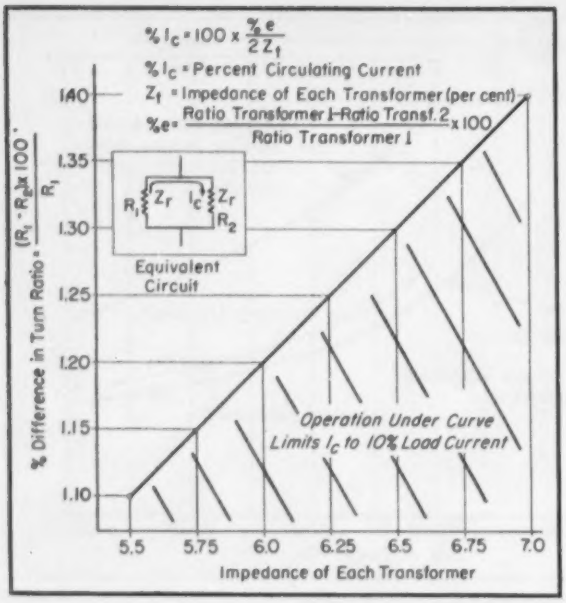


FIG 1—IMPEDANCE and difference in turn ratio are correlated for two transformers of equal impedance and kva but unequal ratios

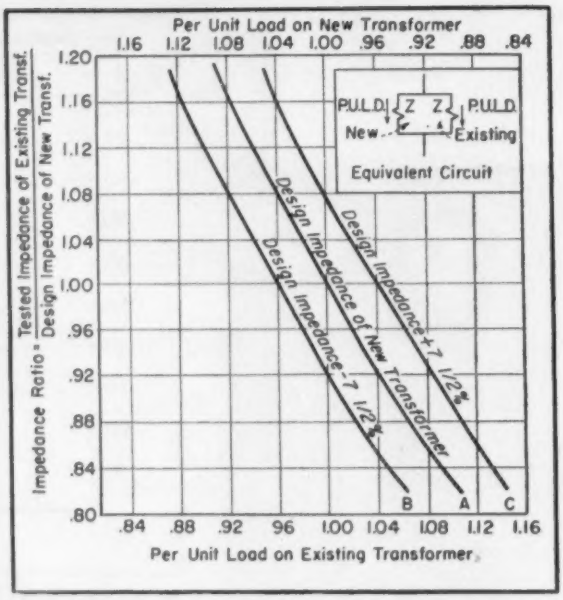


FIG 2—LOAD DIVISION has been correlated with impedance for two transformers which have been rated for equal kva and voltage

ASA and Existing Transformers Can Be Either Paralleled or Banked

Table I—Summary of acceptable variation in transformer characteristics

Connection of Existing and Standard Transformer	Maximum Permissible Variation in Turn Ratio	Maximum Permissible Variation in Impedance	Permissible Variation in Polarity—Single Phase Units	Permissible Variation in Phase Displacement—Three Phase Units
Paralleled	1.4%	22%	Differences may be corrected for by proper external connection	Angular Displacement must be same Other differences may be corrected by external connection or alternate standard
Banked Delta-Delta	2.1%	27%	Ditto	.....
Banked Delta-Wye	Not Critical	Not Critical	Ditto	.....

Allowable differences to limit circulating current or overload to 10% of transformer rated values.

Table II—Allowable maximum and minimum impedance variation of existing unit from standard*

High Voltage Rating	Low Voltage Above 600 V Standard Transformer	Existing Transformer	
	Standard Impedance	Allowable Minimum Impedance	Allowable Maximum Impedance
2400–22900	5.5	4.83	6.21
26400, 34400	6.0	5.27	6.78
43800	6.5	5.71	7.35
67000	7.0	6.16	7.91

Assumptions:

1. Only two units involved in parallel operation
2. Units have same kva ratings
3. Impedance of the Standard transformer falls within ±7½% tolerance.

*Based on loading limited to 110% on either transformer.

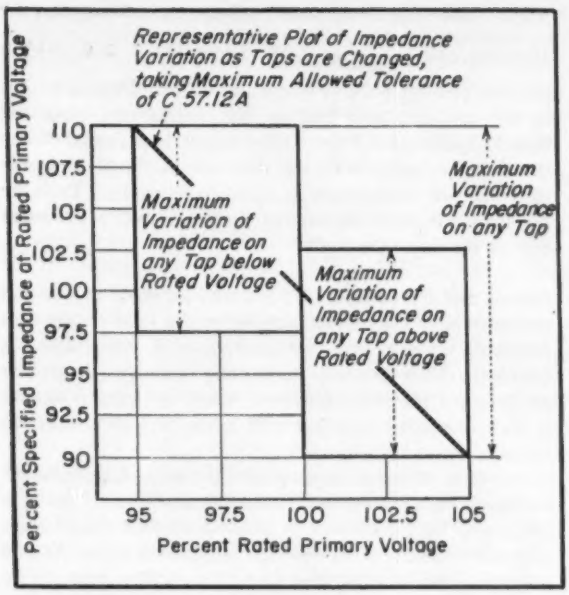


FIG 3—TESTED IMPEDANCE varies with tap changes as indicated in representative plot, taking maximum tolerance of C57.12a

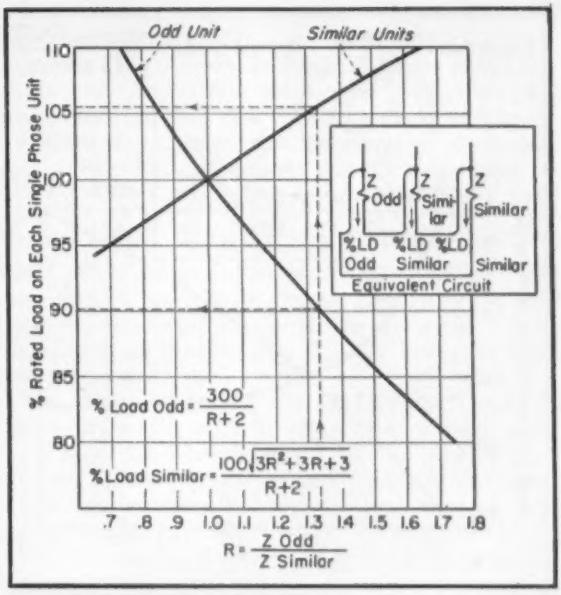


FIG 4—DIFFERENCE IN IMPEDANCE between two single-phase transformers has definite effect on the load division between them

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O. T. KIRBY, Transformer Specialist, Southern District, General Electric Co, Miami, Fla.

Most standard transformers today work successfully in harness with transformers of earlier design, and exact duplication of voltage taps or impedance is usually unnecessary in either paralleling or banking them. These facts are important in view of the predicted doubling of installed power transformer capacity in the next ten years.

Electrical utilities and industrial companies today own many power transformers not conforming to the latest standards for voltage ratings, impedance levels, or mechanical construction, but possessing many more years of useful service. They hesitate between these alternatives: Whether to purchase new transformers to match existing units of earlier designs, or to order transformers in accordance with the latest ASA standard. Combining old and standard units, can save in first cost and delivery time.

Criteria for Paralleling . . . In parallel operation transformers are solidly bussed on both the high and low voltage sides with essentially no impedance in the connections between units. Successful parallel operation involves consideration of turn ratio, per cent impedance, and polarity or angular displacement of each transformer.

As transformer ratings are based on rated nameplate kva only, operation in excess of this rating means some sacrifice of life. A loading of 10% in excess of nameplate rating has been assumed in establishing specific criteria for parallel operation. Under average load cycle and voltage conditions on the circuit, such loading results in a negligible sacrifice in life from a practical point of view. Using this loading as a bench mark, parallel operation is permissible:

1. When no-load circulating current in any transformer does not exceed 10% of its rated full load current.
2. When, with total load equal to the sum of individual transformer ratings, load current flowing in either transformer does not exceed 110% of that transformer's rated full load current.

Turn Ratio . . . When transformers have equal impedance and kva ratings, turn ratio is the important consideration in deciding whether they can be paralleled. Desired turn ratio can be obtained often on a standard transformer even when the rated voltage and tap voltages of the standard are not identical with those of existing units. When 460 v is the low voltage desired on a 2,400-v operating system, a standard transformer rated 2,400 to 480 v can be connected on the 2,520-v tap. The applied 2,400 v results in a low voltage at no load of 457 v. Although kva output is reduced by the ratio of 457 to 480, the loss has no practical significance.

When two transformers of different turn ratios are paralleled, the difference produces a potential causing current to flow through the parallel connection. This circulating current is limited only by transformer impedance of the paralleling connection. Fig 1 shows the maximum difference in turn ratio which will limit the circulating current to 10% of full load current. The difference in turn ratios is even greater, however, when impedance in the external circuit between two transformers is appreciable.

At unit power factor a 10% circulating current adds only ½% to the total current in each unit. At 0.80 pf, 10% circulating current adds 6.4% to the total current in one unit and subtracts 5.6% in the other. These percentages are based on a total external load equal to the sum of the rated kva of each transformer. At lighter loads, the circulating current adds a higher percentage to the total current in each transformer. But this addition is not

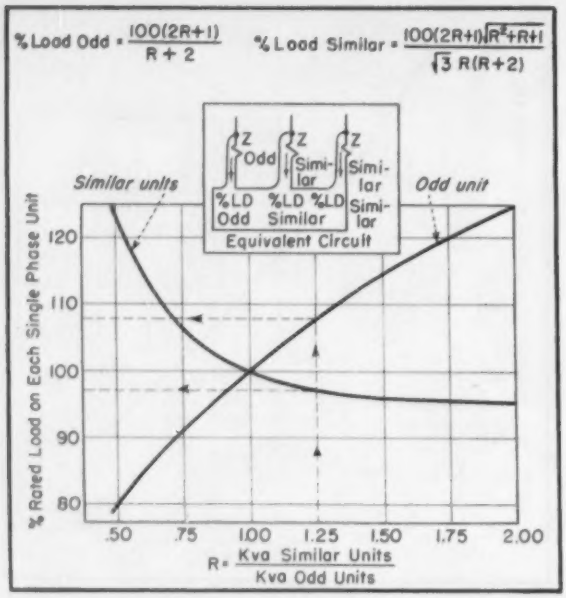


FIG 5—LOAD DIVISION is shown for single-phase transformers which are alike in all respects except that each has different kva rating

significant as the transformers carry less than full load current. Where a moderate difference in turn ratio exists, the effect of circulating current is of little significance.

Impedance May Vary . . . In paralleling transformers, the second consideration is the effect of a difference in impedances. When two transformers, having identical voltage ratings and impedances but unequal kva ratings, are paralleled and connected to a load equal to the sum of the kva ratings, each transformer takes 100% of its rated full load. Thus transformer kva ratings no longer included in the list of standard sizes need not be specified.

Transformers of different impedances when paralleled divide total load in inverse proportion to their per cent impedance on a common kva base. Any difference in per cent impedance is important only when the unit with the lower impedance is seriously overloaded while carrying its calculated share of total bank load.

Standards allow a tolerance of ±7½% from specified values for two-winding transformers so that two transformers whose individual per cent impedances fall within standard tolerances may be readily paralleled. But these tolerances by no means establish maximum deviation in impedance affording practical parallel operation.

The effect of different per cent impedances can be illustrated by the difference in loading between a new unit of standard impedance and that of a "duplicate" of an older 43,800-6,900-v transformer specified for parallel operation. The design impedance of the duplicate is 7%. In Fig 2 the impedance ratio is $\frac{7.0}{7.0}$ or 1.00. The tolerance limits of the duplicate unit allow the actual impedance to vary ±7½% from the design level. The per-unit load on the duplicate unit is 1.04 when the tested impedance is 7½% low and 0.96 when 7½% high. The duplicate unit thus permits a per-unit load division between transformers as great as 1.04 to 0.96.

A new standard transformer has a design impedance of 6.5%. The impedance ratio between the existing and the standard unit is $\frac{7.0}{6.5}$ or 1.08. From Fig 2, it is evident that the greatest possible inequality of load division is 1.08 in the new unit and 0.92 in the existing unit when the tested impedance is 7½% below design impedance. When the tested impedance of the new unit is 7½% high, the load on each transformer is equal to its rating. Thus the practical difference in loading does not justify the extra cost of the duplicate.

Curves and Formulas . . . Fig 2 and all other curves and formulas herein are exact only when the ratio of per cent resistance to per cent reactance of each transformer is identical. They produce sufficiently accurate results for all practical purposes, however, when per cent reactance is high compared with per cent resistance, as is usual in modern power transformers.

Where X/R ratios are different, the sum of transformer kva loads exceeds the combined kva supplied to the load because of the difference in phase angles of transformer currents, resulting from different impedance angles. Where impedance angles differ less than 15 deg, line current may be assumed without appreciable error to be the sum of winding currents.

Table II shows that variation in impedance between a standard transformer of standard impedance with standard ±7½% impedance tolerances, and an existing unit of non-standard impedance paralleled with it which will not overload either unit by more than 10% of rated full load. Even when impedance differences exceed those in the table, some sacrifice in accuracy of load division is often justified to obtain the over-all advantages and economies derived from use of standard transformers.

Load Power Factor . . . When turn ratios and transformer impedance angles are equal and circulating current is zero, load power factor does not affect relative division of load between units. Whatever the division for any combination of load and power factor, it holds for any other load at any other power factor.

Loop Connections . . . When high-voltage windings are fed from a common source through feeders of differing lengths, two transformers may be solidly bussed on the low-voltage side. Such connection tends to improve load division resulting from differences in transformer impedance. But care must be taken to connect the longer feeder to the unit with the lowest per cent impedance.

When two transformers, rated 5,000 kva, 44 kv-6.9 kv, are solidly bussed on the low-voltage side, one fed by two and the other by five miles of 4/0 copper with 5.5 ft equivalent delta spacing, the difference between the feeders results in a 0.54% impedance. For purposes of simplification, it is assumed this impedance has the same X/R ratio as the transformer impedance. If, then, an existing unit having 7.0% impedance is fed from the two-mile line and the standard 6.5% impedance unit from the five-mile line, the load division is 101-99. Thus the external loop connection may easily have more effect on load division than the actual difference in transformer impedance.

Variation of Impedance . . . Before adoption of ASA C57.12a, there was no established industry standard specifying how the per cent impedance might be permitted to

vary from one tap position to another. Specific requirements now cover impedance variation on tap positions as shown in Fig 3. The user, purchasing standard units from different manufacturers at various times, is now assured of successful parallel operation on appropriately selected tap positions. Thus one more step has been taken to eliminate the need of specifying duplicates.

Impedance Equalization . . . Equalization of impedance between units may be effected by reactors in series with the secondary winding of the lower impedance unit. The reactors' cost obviously enters into the economics of such an arrangement, except where they are surplus equipment or emergency conditions make this solution desirable. Additional reactance for successful paralleling has been obtained by threading low-voltage leads through a windingless iron core containing an air gap.

Polarity and Phase Displacement . . . In determining whether two transformers can be paralleled, consideration must be given to the polarity of single-phase units and the angular displacement of 3-phase units. Standard single-phase units can be paralleled with existing units, whether or not of the same polarity, by connecting correspondingly marked terminals together, that is, H_1 to H_1, X_2 to X_2, etc. This method works with either single-phase installations or 3-phase installations made up of single-phase units. Where polarities of the units are identical, the external connections are symmetrical; where of opposite polarity, the connections are unsymmetrical.

Standard 3-phase transformers are available with delta-delta, delta-wye, and wye-delta connections. A delta-delta connected 3-phase unit having standard zero phase displacement can be paralleled only with transformers connected delta-delta or wye-wye also having zero phase displacement. Where existing units have 180-deg phase displacement, an alternate standard construction may be specified, providing the desired phase displacement for present use and a terminal board arrangement for future changeover to the standard phase displacement.

Delta-wye or wye-delta connected standard transformers can be paralleled with existing units connected either delta-wye or wye-delta. The ASA C57.12a standard delta-wye and wye-delta connected units both have the high leading the low voltage by a 30-deg displacement. When the existing delta-wye transformer has a different phase displacement, the difference can be overcome by the proper external connection. The proper external connection can also overcome the difference in phase rotation between a standard 3-phase unit and an existing unit.

When the consequent unsymmetrical arrangement of connections is not acceptable to the user, a standard ASA C57.12a transformer of alternate construction can be specified, as in the case of the delta-delta units. This should match the existing unit's phase displacement or phase rotation now and provide for changing the unit readily to standard arrangement later.

Bank Operation . . . An open-delta bank of existing single-phase units may require a new unit to close the delta, thus increasing the bank's output; or, new units may be needed to form a 3-phase bank using one or two units from existing stock. Two basic connections of three single-phase units in a bank are usually encountered: delta-delta and delta-wye. Equal line currents are assumed for both.

In a delta-delta bank the division of load between units is equal only when individual transformers have the same impedance. Fig 4 shows the relation between impedance and load division for three transformers of equal kva and voltage when only two have the same per cent impedance.

Division of load among three units, each of two similar units having 6% and the odd unit 8% impedance, is shown by dotted lines in Fig 4. At this impedance rate of $\frac{8}{6}$ or 1.33 the odd unit carries 90% and each similar unit 106% of its rating. When the 1.33 impedance ratio exists between two otherwise similar units in parallel, the lower impedance unit carries 114.4% of its rated load. Thus impedance differences are even less critical for bank than for parallel operation.

The relation of load division to impedance in delta-delta banks permits banks of widely different kva ratings. Fig 5 shows the relation between kva and load division for three units with equal per cent impedance and equal voltage, but dissimilar kva ratings. When there are two 1,250-kva and one 1,000-kva unit, the rated load being 3,500 kva, the odd unit carries 107.5% of its rating and each similar unit 97%.

Turn Ratio May Be Off 2.1% . . . In the delta-delta connection a difference in turn ratio is much less critical for banking than for paralleling. In parallel operation the impedance of only two transformers limits circulating current. In bank operation three transformers offer impedance to circulating current. A given difference in turn ratio for transformers of the same impedance results in a bank circulating current only two-thirds that of the parallel connection.

On a bank of 7% impedance units the turn ratio may be off as much as 2.1% without exceeding the allowable 10% circulating current. In delta-delta bank operation, just as in parallel operation, units of different voltage, kva ratings, and per cent impedance may operate successfully.

Delta-Wye Banks . . . The other basic bank arrangement is the delta-wye or wye-delta connection of three single-phase units. When the neutrals of the wye-connected winding and of the load are grounded solidly, there is no substantial difference in the load-division characteristics of the delta-delta and delta-wye connections. When one or both neutrals are isolated, the two connections have quite different characteristics.

Because of the wye the delta-wye connection provides only one path between two lines consisting of two phases in series, thus giving the connection the characteristics of a series circuit. The division of current is then entirely independent of the difference in characteristics of individual transformers. A wye-delta bank may be made up of units of widely differing impedances without appreciably affecting current division. For this reason, a balanced 3-phase load is equally divided among the phases regardless of impedance differences. In this connection there is no excessive circulating currents in the delta, and circulating currents cannot be reproduced in the wye-connection; there are only magnetizing, small currents. A difference in turn ratio is not critical.

When transformers in the bank are not all equal in kva rating and the 3-phase load is balanced, the bank's output is limited to three times the permissible kva loading of the smallest transformer.

Calculator-Rental Market Slumps

Survey shows that requirements of utilities total 140 calculator weeks a year. But rapid increase of analyzers has put 270 weeks a year on market.

HERBERT P. PETERS, Supervisor, AC Network Calculator, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga.

The number of ac network calculators in the United States has greatly increased since 1947. Then there were only 13. But 20 have been installed since for a total of 33. Definite plans have been made for three others and tentative plans for two more. Thus since 1947 the number has tripled. In the same period installed generating capacity has increased from 52,000 to approximately 100,000 Mw or over 90%.

These increases in capacity and calculators, required in the necessary system planning to accompany the system additions, are perhaps nearly enough in line not to indicate a serious unbalance. However, as a power system increases in size, the generators installed also increase in capacity. In 1947 the average was 60 Mw or smaller. Now the industry is thinking in terms of 100-Mw or larger units. But no matter the size of the unit the amount of system planning is about the same; so calculator time required increases but slowly.

Survey Gets the Facts . . .

Knowing the considerable amount of unscheduled time during the past summer on the calculator with which the author is associated and realizing that the number of calculators is growing, the author made a survey of the calculator-rental market.

All companies with a capacity of 100 Mw or over were contacted. Of 130 operating companies questioned, 94 or 72% replied. An estimate based on general knowledge of the comany's operations was made of those not replying. Every effort was made to prevent duplication of time occasioned by joint studies. The questionnaire asked:

1. Calculator time used, past and estimated future.
2. Affiliations with certain calculators.
3. Size of calculator required to represent system.

Questionnaires were also sent to 35 operators of existing or planned calculators. Of these 26 or 74% replied. Again an estimate was made of those not heard from. This questionnaire asked:

1. Size of equipment.
2. Amount of time available for rental.
3. Effect of rental income on services.

Co-op Calculators Hurt Rental Market . . .

Twelve cooperative calculators (usually several power companies and a university) have taken 41 companies from the "open" market. Sixteen companies have their own calculators; so only 73 of the companies surveyed are possible renters. Only these are considered in this piece. Similarly only the rental time available on the non-cooperative calculators is included.

An average of the last three years showed power companies used non-cooperative facilities 115 calculator weeks a year. Future requirements would be 128 weeks. Allowing for use by small companies, industrial plants, and REA co-ops, a future demand of 140 weeks seems reasonable.

Calculator operators indicated they would like to rent them 270 weeks a year. This would indicate that there is an oversupply of calculators.

Reason for the oversupply apparently is the cooperative installations which removed many of the most active users from the "open" market. Most of these installations are at universities (15) which seem to have the impression that there is an unlimited demand for them by power companies and that they are a teaching aid.

The first calculator in the U. S. built by General Electric Co at Massachusetts Institute of Technology has recently been sold. In answering the questionnaire, Gordon S. Brown, head of the Electrical Engineering Department, said:

"We found that we could not afford it unless we rented it to power companies. Our gross revenue averaged about $10,000 a year. After paying the salaries of operating assistants, this just about took care of our expenses.

"Because of the need to schedule its use for the companies, its availability as an educational tool was often subordinated to second place."

Small Calculator Will Serve a College . . .

Prof. L. M. Haupt, supervisor of the calculator at Texas A&M, took another approach:

"I think it is a mistake for all colleges to want a large calculator, but a small one with a very limited number of circuits would be very desirable. For instruction purposes you do not need over three generators, six loads, and 12 lines."

If the number of calculators keeps increasing, it will be to the disadvantage of the power companies as it will be impossible for all operators to maintain an adequate staff and services with a reduced income.

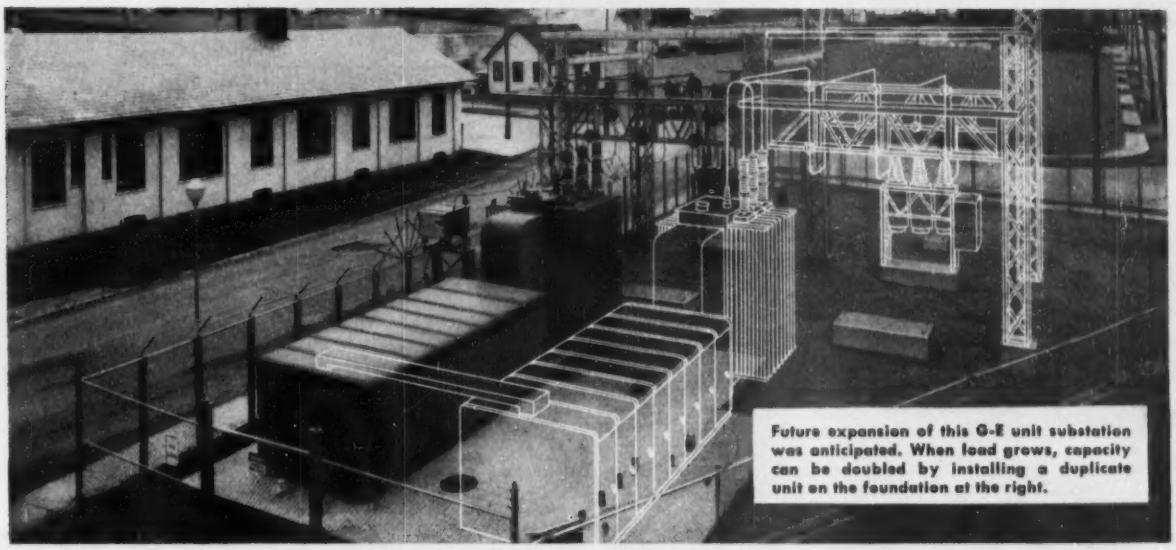
How Big Should a Calculator Be? . . .

The survey brought out the necessary size of equipment required to handle adequately the power systems: The percentages are based on the estimates of all companies surveyed. The figures in parenthesis are based on the omission of member companies of the cooperative calculator installations:

52% (64%) of the power systems can be set up on a calculator with 12 generator units.

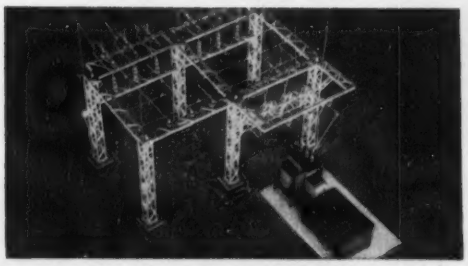
88% (92%) of the power systems can be set up on a calculator with 18 generator units.

97½% (100%) of the power systems can be set up on a calculator with 24 generator units.

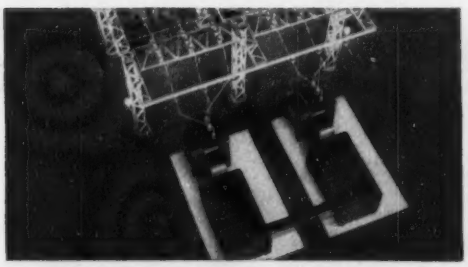


Future expansion of this G-E unit substation was anticipated. When load grows, capacity can be doubled by installing a duplicate unit on the foundation at the right.

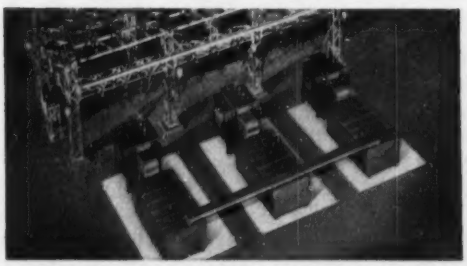
This General Electric substation is designed to grow with your load



1954 Single unit is installed, but load growth is anticipated and additional steel structure is also installed at this time.



1956 Capacity doubled to meet load growth. Bus tie provides emergency interconnection to restore service in case of outage on high side.



1958 Capacity tripled as load growth continues. Low-voltage-selective arrangement provides service continuity in emergency.

And with this arrangement, it's easy to—

1. **double or triple capacity by adding duplicate units**
2. **add additional "match and line-up" feeders**
3. **make connections to the high-tension structure**

General Electric unit substations make it both easy and economical to supply growing loads. By adding capacity in small units, as shown at the left, utilities avoid investing in overcapacity which will not be used for years—and which may never be used.

With G-E unit substations, it's easy to increase capacity by simply adding additional units. In this low-voltage selective arrangement, a bus tie with normally open tie breaker provides an emergency interconnection between the low-voltage sides of two or more individual substations. This permits restoration of service following an outage of either a transformer or high-voltage circuit.

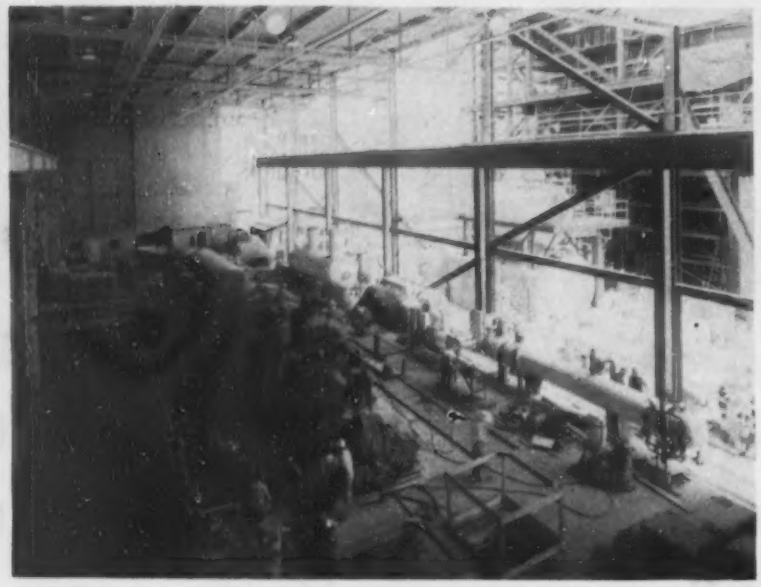
Additional "match and line-up" feeders can easily be added to this design because the ends of the switchgear are accessible—not bottled up as in the case of double-ended substations. Additional match and line-up feeders will be available from the factory for years after the original equipment was purchased.

Standard high-voltage steel structure is another factor in easy expansion. It's easy to add to the structure if more lines are brought in, or if more units are added.

For further information about unit substations that provide easy expansion with a bonus in service continuity, ask your G-E apparatus representative for bulletins GEA-3800 and GEA-5847 or write to General Electric Company, Schenectady 5, New York. 513-2

GENERAL ELECTRIC

Partially Enclosed Turbine Room Reduces Noise Level



INDOOR-OUTDOOR TURBINE ROOM contains one new 156-Mw generator within three walls of the building. Wall was left off the side that is away from the ocean and wind front

EDWIN H. KRIEG, Consulting Engineer, Stone & Webster Engineering Corp, Boston, Mass.

Enclosing only three sides of a turbine room—believed to be the first installation of its kind—is expected to reduce noise level at Redondo Beach steam plant of Southern California Edison Co. The partially enclosed room located in a climate favorable to outdoor stations was decided on because the plant is located near a residential area and Moonstone Beach.

In the installation one entire side of the turbine room was omitted, from the operating deck to the roof, as illustrated. The same side from the deck to grade level was also omitted.

The three-sided room will reduce noise level, provide sufficient protection for equipment, reduce building costs and investment in ventilating apparatus, while providing benefits of cool operating conditions.

Electrical Aerial Ladder Has Wood and Glass Fiber Section

P. E. LANDSEM, Superintendent, Oregon City Division, Portland General Electric Co, Oregon City, Ore.

GLASS FIBER-WOOD upper section of an all-electric aerial ladder provides added safety for work on energized primary lines. All-purpose truck has a set of hot-line and pneumatic tools

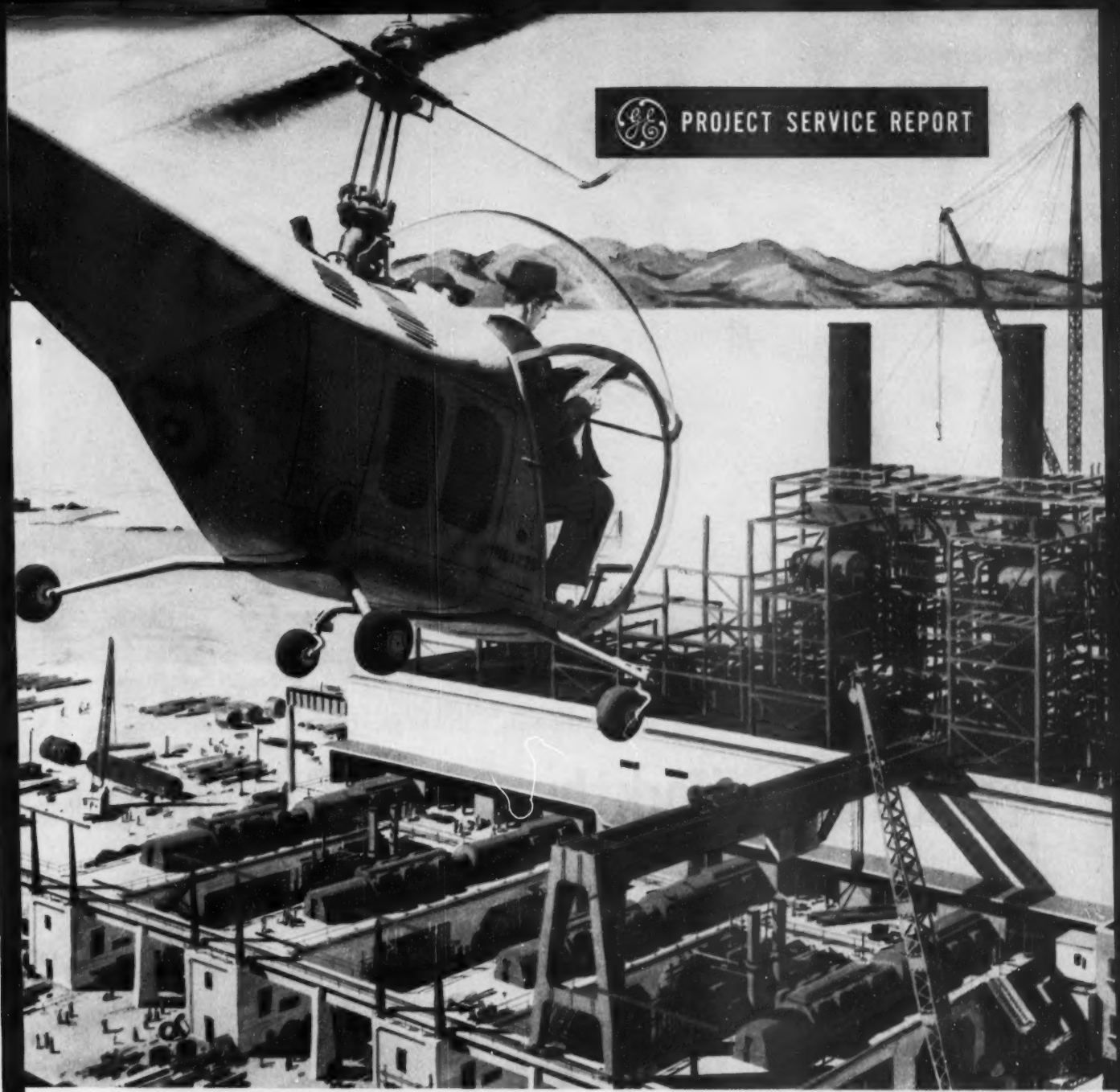
For tree trimming and general line work, an electrically-operated, truck-mounted ladder has been designed that incorporates one ladder section made of wood and glass fiber. The aerial unit is used by Portland General Electric Co to speed work in energized primary voltage areas.

In general, the ladder and its mount are made of standard components to reduce initial and maintenance costs. The lower steel section of the ladder is about 18 ft long to minimize the danger of its touching energized lines. The 18-ft upper section is made of glass fiber and wood. The glass fiber is unaffected by climate and has almost the tensile strength of steel. Its dielectric strength is an added safety factor during work near energized lines.

A working platform is on top of the upper section. Foot-operated buttons in a control box mounted on the platform floor give the lineman full control over ladder movement. A second control box is at the base of the ladder. A remote control switch in the main power circuit provides added safety and is operated by a button in either control box to cut off all power for the ladder. The circuit must be reclosed manually to restore power.

The pedestal base of the ladder is mounted on a 1½-ton truck chassis and standard 104-in. body. To rotate the ladder, a 12,000-lb winch housing is used. Power for the ladder is produced by a reversible 6-v starting motor that develops about 10 ft-lb of torque. It can rotate the ladder 360 deg at ¾ rpm. The motor drives into a 100:1 reducer, then through a 1.25:1 chain reduction, and finally through the main reducer, which has about a 34:1 ratio. Total reduction is about

(*Continued on page* 99)



'COPTER VIEW OF PG&E'S Pittsburg station, largest in PG&E system, shows four G-E turbine-generators.

4 G-E turbine-generators to produce 600,000 kw at new PG&E steam plant—largest in West

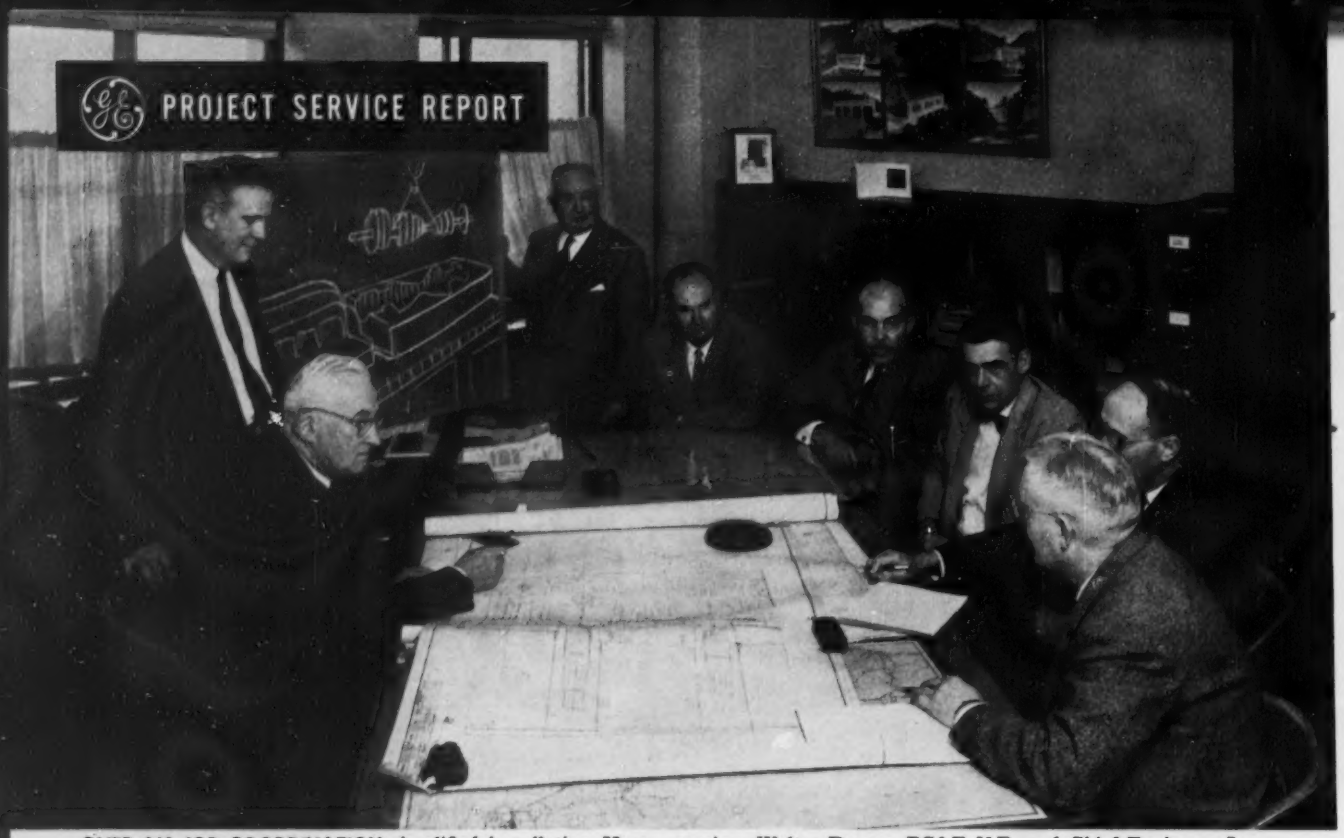
Highlighting Pacific Gas & Electric's new Pittsburg, California, plant are four General Electric turbine-generators. These units, part of the 75-million-dollar project, largest of its kind west of the Mississippi, provide the Pittsburg station with a nominal operating capacity of 600,000 kw and a maximum capability of 625,000 kw.

Backing up efficient planning by PG&E and Bechtel Corporation, engineers and constructors, General Electric engineers made vital contributions which helped achieve on-time start-up, and low cost per kw.

GENERAL ELECTRIC

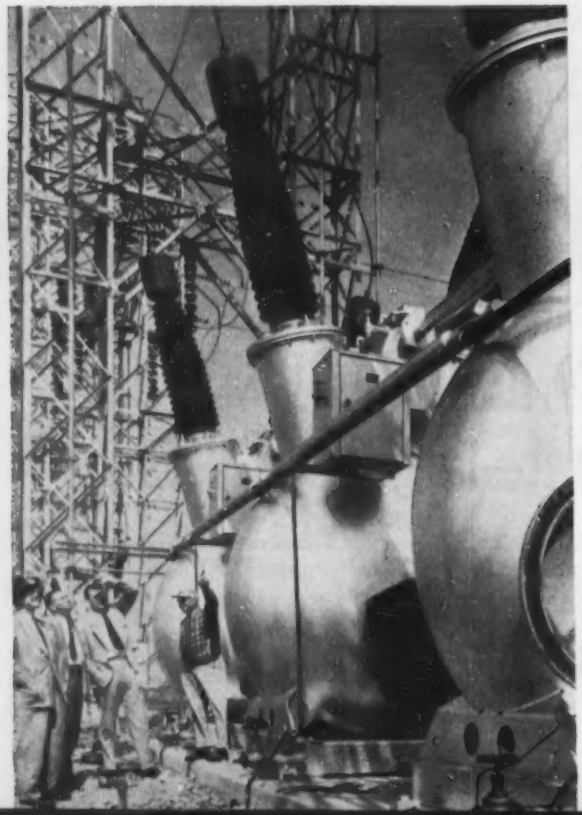
For installation story, see next page ➧

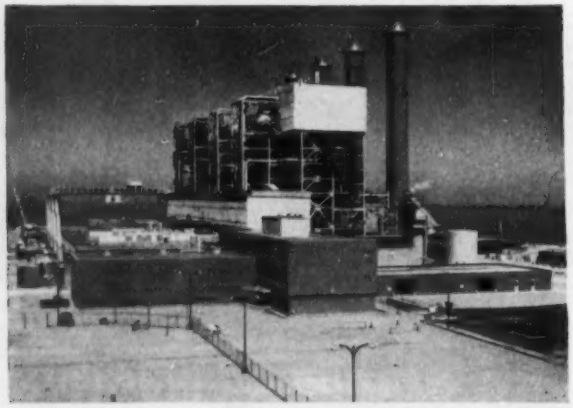
PROJECT SERVICE REPORT



OVER-ALL JOB COORDINATION simplified installation. Here at one of several planning meetings, M. S. Barnes, G.E. (third from left), discusses technique of lowering rotor into frame of turbine with (l to r) R. A. Bowman, Bechtel Mgr. of Engineering; Walter Dreyer, PG&E V.P. and Chief Engineer; J. Kiely, Bechtel V.P.; A. J. Swank, PG&E V.P., General Construction; J. D. Webster, G.E.; F. E. Baxter, PG&E Manager, Purchases; C. C. Whelchel, PG&E Chief, Steam Engineering.

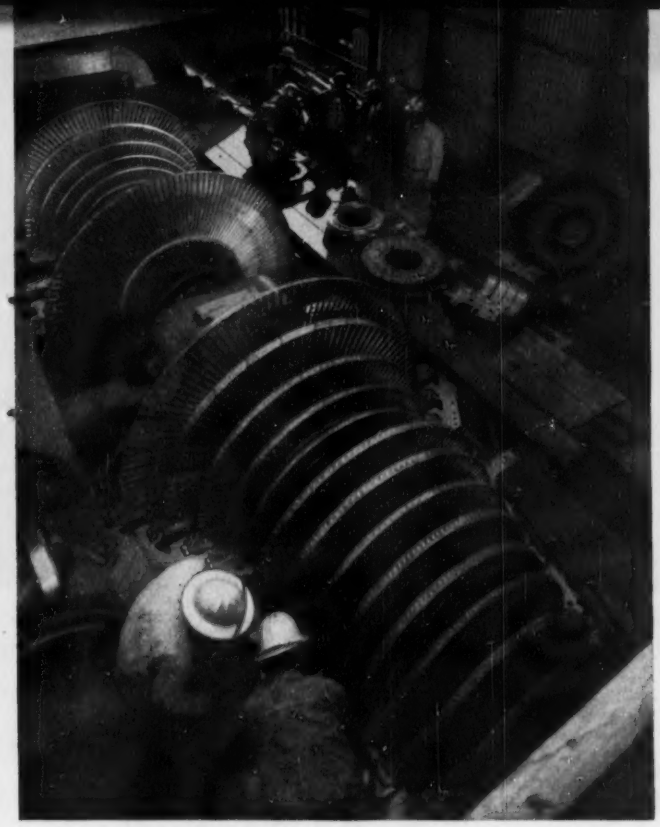
Project teamwork by G.E., PG&E and





ALL SHIPMENTS ON SCHEDULE meant faster construction, earlier start-up for Pittsburg station, thanks to simplified ordering, scheduled equipment production and delivery through G-E Project Service.

ENGINEERED AS A PACKAGE, entire switchyards can be supplied through G-E Project Service. Here, G-E installation engineer J. Anderson discusses safety features of 230-kv breakers with Karl Bausch, Bechtel Chief Electrical Engineer, Power Division; Ray Stater, Bechtel Supt. of Construction at Pittsburg plant; and J. D. Webster, G-E Sales Engineer.

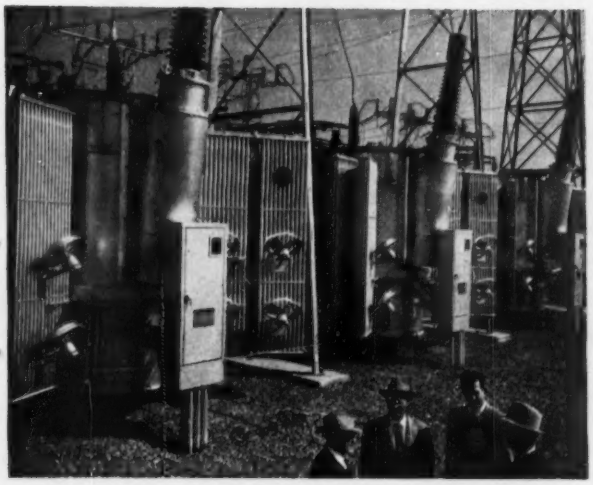


CAREFUL SUPERVISION of installation, part of G-E Project Service, is given by R. Yanofsky, G-E Turbine Installation Supervisor; W. Todd, PG&E Engr.; J. F. Del Curo, Bechtel Chief Mech. Engr.; W. A. Youker, G-E millwright foreman.

FAST INSTALLATION of 2250-hp G-E Boiler Feed Pump Motors resulted from careful planning in early stages and coordinated shipment. G. E. Green, G-E Motor Specialist; J. F. Del Curo; and R. Stater watch final wiring.

Bechtel keeps construction costs low

Reduced installation costs result from PG&E's and Bechtel's use of sound design and new engineering trends



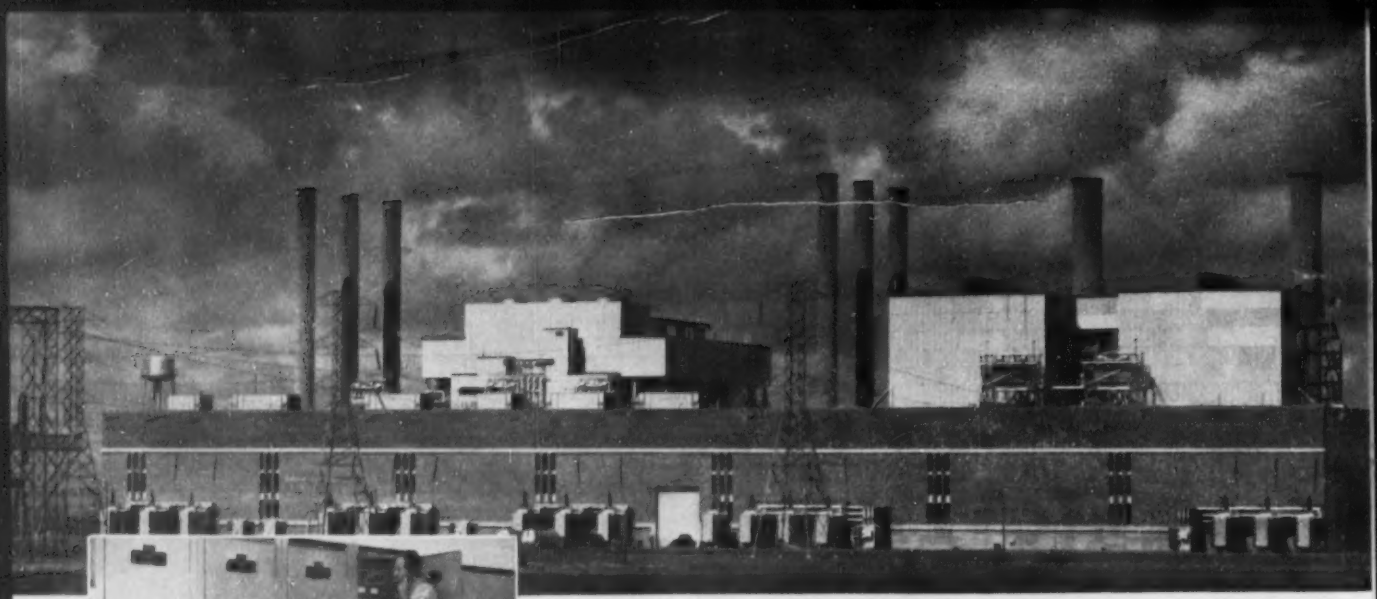
FUNCTIONAL LAYOUT of three 220/127-kv G-E transformers is discussed by G. E. Bachman, Bechtel Supervising Engineer; R. C. Prince, Bechtel Engineer; G. B. Gilcrest and C. L. Phillips, G-E application engineers.

With General Electric providing engineering aid, making apparatus delivery schedules coincide with construction progress, and supplying thorough installation service, the Pittsburg plant, a tribute to the farsighted electrical utility industry, was ready to fill California's growing power needs.

By contacting your Apparatus Sales Office early in the planning stages of your new expansion or modernization you will obtain the greatest benefit from G.E.'s project services. A team of experienced G-E engineers can assure unified responsibility. Behind this team, the vast resources of General Electric stand ready to give ordering, engineering, design, manufacture, shipping, and installation service.

GENERAL ELECTRIC

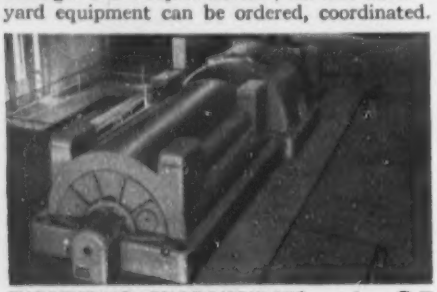
More station details on next page ➧



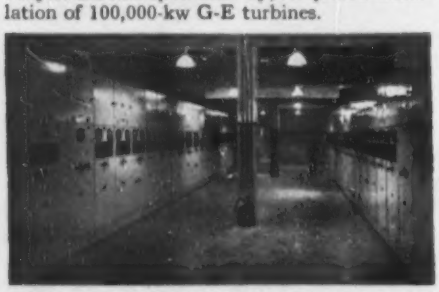
COMPLETE ELECTRICAL COORDINATION plus on-schedule production and delivery of all electrical apparatus through G-E Project Service helped cut cost of giant Contra Costa station for Pacific Gas & Electric.

TRAINING OPERATORS to handle equipment like these carrier current communication units is assured by G-E Project Service.

VALUABLE ENGINEERING TIME is saved—through G-E Project Service, all this switchyard equipment can be ordered, coordinated.



ENGINEERING THOROUGHNESS under G-E Project Service sped delivery, simplified installation of 100,000-kw G-E turbines.



COMPACT EQUIPMENT, like this metal clad switchgear helps reduce space requirements.

Sound design practices helped cut Contra Costa costs for Pacific G&E

Project Team helped Bechtel meet PG&E's start-up deadline for 575,000-kw station

Like its Pittsburg installation, PG&E's 575,000-kw Contra Costa station typifies the cost-saving advantage of sound engineering supported by General Electric project services. Here, too, a G-E Project Team coordinated its efforts with PG&E and Bechtel engineers. Headed by a G-E Sales Engineer who drew extensively on General Electric's vast manufacturing and testing facilities, the teamwork of the application engineer, the system and product specialists, and coordinators helped provide faster construction, lower installation costs for PG&E.

For full data on G-E project services, contact your nearest Apparatus Sales Office. Or write for GEA-6032 to General Electric Co., Section 302–4, Schenectady 5, N. Y.

MORE POWER TO AMERICA

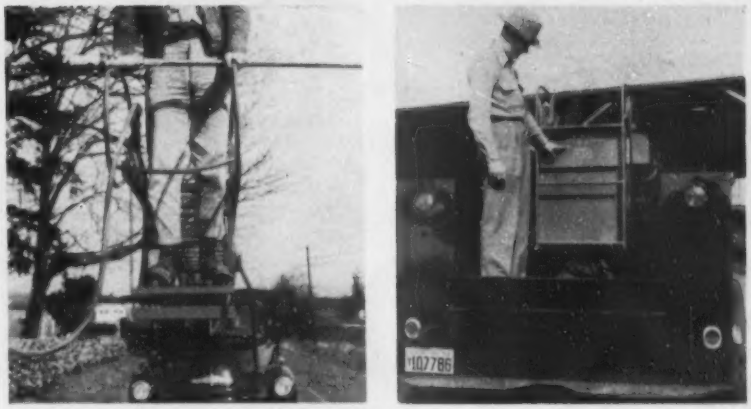
GENERAL ELECTRIC

Aerial Ladder

(*Continued from page* 94)

4,400:1. A similar motor operates the ladder extension.

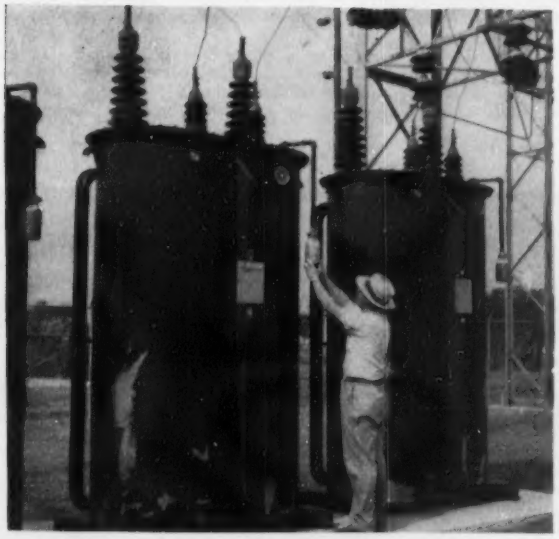
The ladder is raised by two 6-v, 1-gpm, 1,500-psi gear-oil pumps connected to a 3-in., 10,000-psi ram. The ram is between the pedestal and the lower section of the ladder. To lower the ladder a 6-v solenoid valve is used. In case of power failure, the valve allows a manual release to lower the unit. Power for the ladder is supplied by two standard Group 4 batteries in parallel. Total cost of the ladder truck, including the chassis and body, is about $7,000.



PUSH-BUTTON CONTROLS on the working platform (left) and at the base of the ladder (right) control all movements of the ladder. Power may be cut off in either control box

A full set of hot-line tools has been added to the working equipment to speed mid-span repairs. A 60-cu-ft compressor, for operating the pneumatic tools, is mounted between the cab and the body. Two linemen on the platform can transfer primaries from one pole to another and change transformer taps. Working from the ladder under ideal conditions, two linemen can change 75 taps in one day. Without the ladder two pole-climbing linemen can change approximately 30 taps per day.

Bottled Silica Jel Eliminates Condensation in Transformers



TRANSFORMERS BREATHE into jars containing silica jel which absorbs moisture, thus eliminating condensation in transformers

MARVIN H. GEBHARDT, Minnkota Power Cooperative, Inc, Grand Forks, N. Dak.

Causing substation transformers to "breathe" into a dehydrating silica jel has solved the problems of condensation in transformers for Minnkota Power Cooperative, Inc. Breathers on transformers are equipped with pipe connections that terminate in a glass jar containing the silica jel. The silica jel absorbs the moisture in the atmosphere and keeps it out of the transformer.

Jel is blue when fresh and gradually changes to pink as it absorbs moisture. In this way it is easy to tell the degree of saturation of the jel and to know when it needs changing. Replacement of the jel is required approximately every three months on 333-kva transformers. Weighing the jel before and after drying indicates that about a cup of moisture is collected by each breather in that period.

Saturated crystals are reactivated by placing them in small woven wire baskets and drying them in an oil filter blotter oven at not over 275 F. Drying is continued until the jel crystals are restored to a deep blue color.

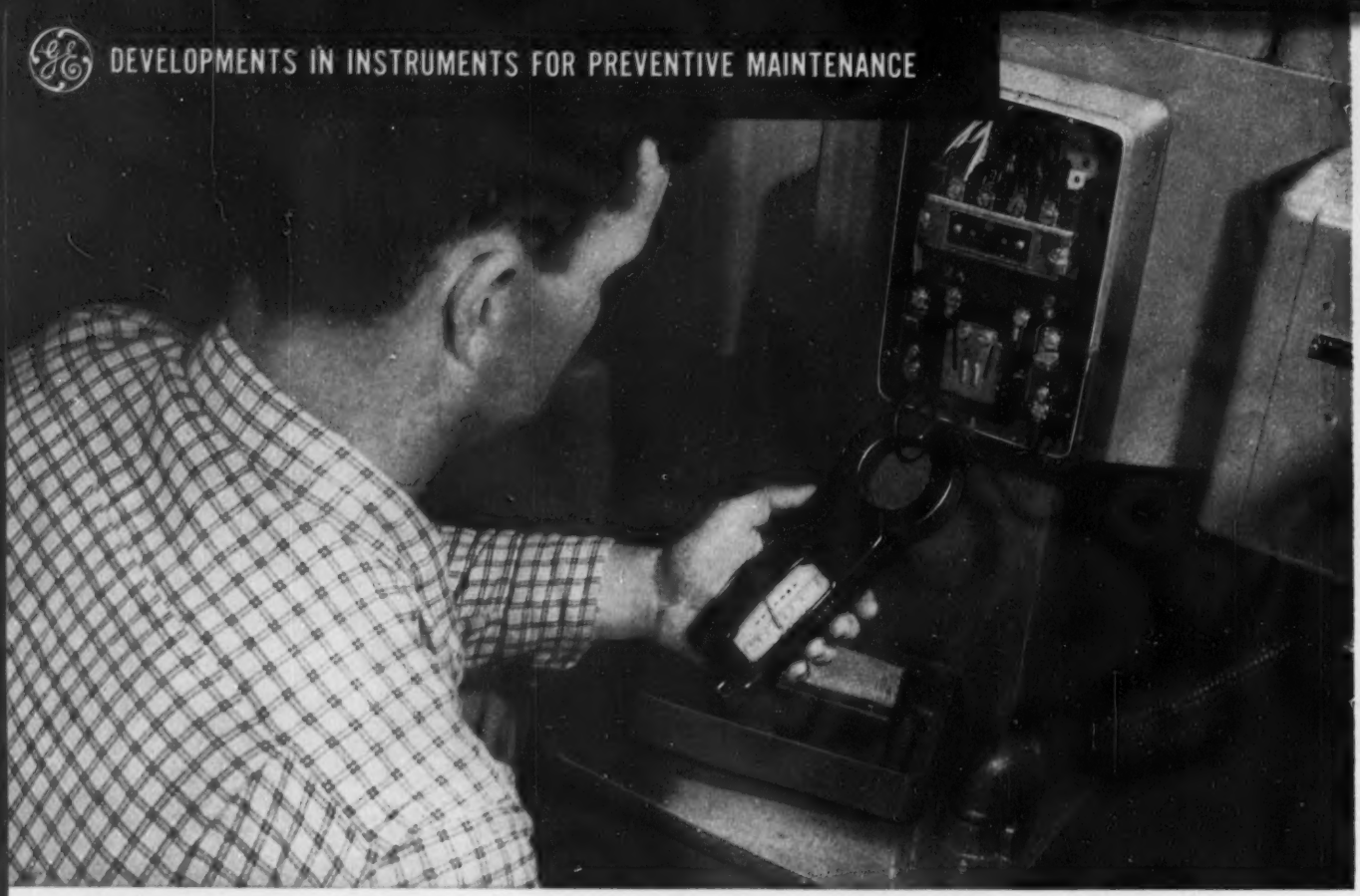
Rewinding Motors with Class H Insulation Increases Output

A. J. FALCONE, W. E. COOVER, Consolidated Edison Co of New York, Inc, New York, N. Y.

Rewinding Class A insulated motors with Class H insulated windings appreciably increases the horsepower rating of the motors. Cost to rewind is about half the cost of a new Class A motor capable of carrying the increased load. Increased capacity obtained, ranges from 20% to 75%, depending upon the mechanical design of the specific motor and the hottest spot temperature allowed for the application.

Moreover, rewinding has eliminated the expense that would have been incurred to change power plant foundations, piping, ducts, etc. if new larger Class A insulated motors had been purchased.

(*Continued on page* 102)



CHECKING ON SMALL MOTORS is one of the biggest problems in motor maintenance. Here the new volt-ammeter is being used to indicate motor current, as protection against under- or over-loading. The hook is completely insulated and has dovetail joint fittings. This minimizes the possibility of errors due to dirt in the air gap or improper closing of the hook. Insulation covering reduces the possibility of grounding or short-circuiting the circuit being measured. Hook will clamp on conductors up to 2 inches in size.

POCKET-SIZED HOOK-ON HAS AUTOMATIC SCALE

Easy-to-read Scales Are Marked in Red for Volts and Black for Current

TROUBLE SHOOTING is easily performed by this new instrument. Here, as a voltmeter, the AK-4 is checking the continuity of a circuit to determine which fuse has blown.

EFFICIENCY ANALYSIS of polyphase circuit is being checked here to spot overload feeders. This prevents poor voltage regulation and inefficient operation of equipment.

General Electric Announces New, Versatile Hook-on Volt-ammeter With Wide A-C Range

Measures 3 Voltage and 5 Ampere Ranges

The new General Electric AK-4 volt-ammeter is the first pocket-sized hook-on to feature a-c current ranges of 10-30-100-300-800 amperes and voltage ranges of 150-300-750 amperes. Combined with the new pointer stop, which permits the measurement of voltage or current of short duration, these eight ranges give you new expanded versatility in preventive maintenance.

POINTER STOP mechanism enables you to get accurate reading by holding the needle-thin pointer within a desired range. You merely set the stop and it holds the pointer to a limited movement on the scale. This permits readings of minute measurements that would be difficult to get if the pointer moved up and down the entire scale.

AUTOMATIC SCALE CHANGING assures you of reading the right scale every time. Simply turn the knob selector switch to the desired range and the scale is changed automatically, giving you the correct scale every time. Scale is full 2⅜ inches in length to insure greater accuracy in readings.

Engineers, contractors, electricians, maintenance and servicemen will find this new G-E pocket-sized hook-on ideal for balancing circuits, estimating new or revised distribution circuits, tracing faults and grounds or diagnosing operating troubles without shutting down equipment.

LOW PRICE includes leather case and 3½-foot screw-in leads with insulated alligator clips. Shock-resistant design protects instrument in normal use. Screw-in voltage leads cannot be pulled out accidentally, giving more protection during actual tests.

CHANGING AND FINGER-TIP RANGE SELECTOR SWITCH

SECTION B602-281
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, N. Y.

Please send me a copy of the bulletin (s) checked below:

- ☐ GEA-5469 Buyer's Guide for Testing Instruments
- ☐ GEC-901 AK Hook-on Indicators

Name .....

Address .....

City .....

State .....

OVERHEATING CHECK prevents voltage from getting low enough to cause serious damage. Supply voltage can easily be checked with this handy pocket-sized instrument.

EXCESSIVE LINE CURRENTS can be spotted with this new volt-ammeter. Here a transformer system is being checked for overloading, due to unusual amounts of currents.

GENERAL ELECTRIC

Rewinding Motors (*Continued from page* 99)

The table shows actual results obtained by rewinding power-plant auxiliary motors with Class H insulation.

The 350-hp and 800-hp motors were not given a new horsepower and temperature rise rating because they were changed at the time when silicones were first being used as insulation for windings. These motors have a trouble-free operation record of ten or more years at the higher loads indicated.

Although the rewound motors are able to withstand the higher temperatures corresponding to the increased loads, the torque characteristics remain the same unless they can be increased by a change in the design or method of connecting the stator windings.

Results of Rewinding Motors

Application	Number Re-wound	Motor Rating Before Rewinding	Motor Rating After Rewinding
Salt water service pump	1	350 hp 55C rise	To carry 420 hp load
Boiler feed pump	2	800 hp 50C rise	To carry 950 hp load
ID and FD fans	9	600 hp 40C rise	750 hp 75C rise

Taped Radio Antennas Prevent Shock Accidents

Wrapping three mils of high-voltage adhesive tape on a two-way radio antenna mounted on a truck is expected to eliminate personnel hazards if the antenna contacts a high-voltage bus. This is the result of a study by Northern States Power Co that was started after two linemen of another company were seriously shocked when radio antennas contacted energized lines.

Wrapping is started at the top of the antenna where a cap of three thicknesses of tape is applied. It is continued all the way down the antenna with a ⅔ lap, providing a thickness of three mils.

The tape having a thickness of one mil tests at 10,000 v per mil. Three layers on the antenna test the full 30 kv for three minutes. Deliberate mechanical abuse has been given the taped antennas by repeated beating going in and out of garage doors. This had very little effect of the dielectric strength.

Antennas are retaped when necessary.

Truck Straps Hold Crossarms Off Ground to Aid Fitting Work

MARLIN THURMOND, Line Superintendent, Potomac Edison Co, Hagerstown, Md.

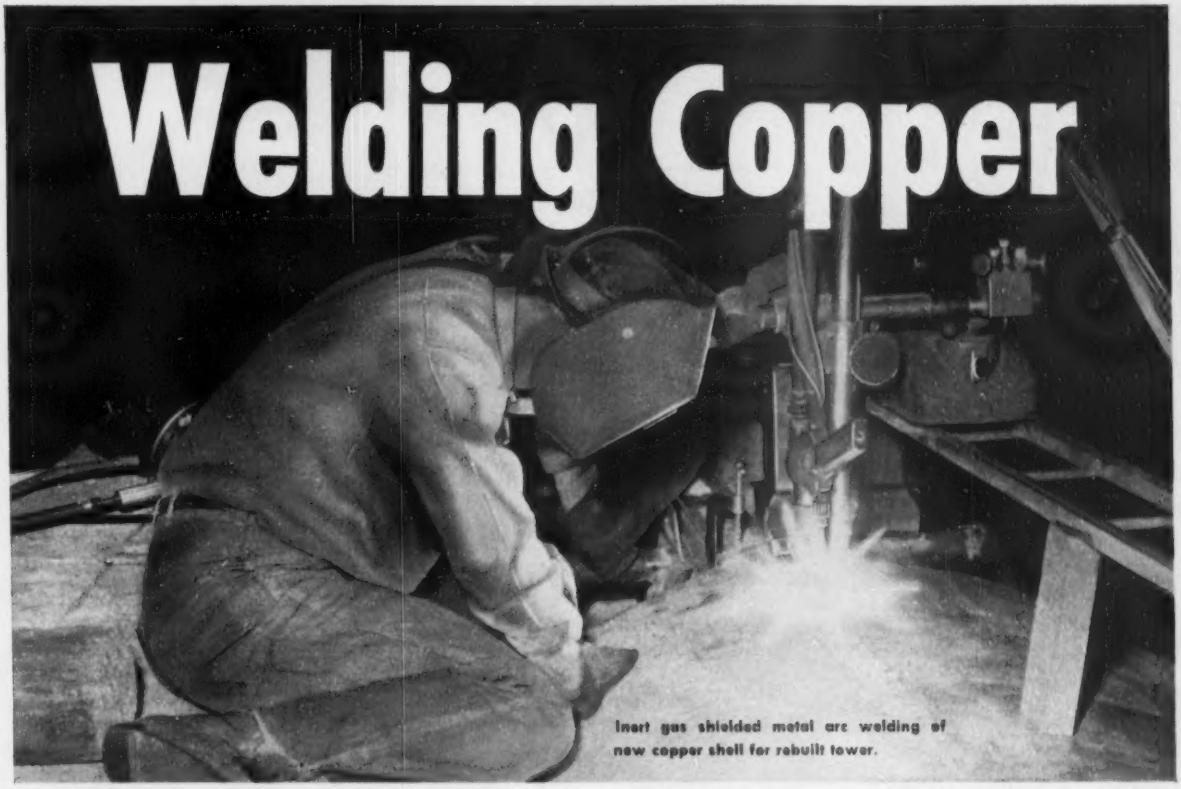
Two strap iron brackets welded to the underside of a truck hold crossarms horizontal and waist-high to facilitate fitting work. They have been especially helpful during snow or rain as crossarms are kept free of slush and mud. As an auxiliary use the brackets form a step for easy access to the rear of the truck bed.

The two brackets are made from ¾ x 2-in. strap iron, formed in stirrup shapes, and welded to the underside of the frame to which the trailer hitch is fastened. One bracket, in conjunction with the underside of the truck, holds a crossarm so that either its top or bottom can be worked on from above. The other bracket holds a crossarm so that either side is up.

Previously, fitting work was done while crossarms were on the ground or leaning against the truck.

(*More How To on page* 108)

Welding Copper



Inert gas shielded metal arc welding of new copper shell for rebuilt tower.

SAVES 38% in materials and labor for joining

Some time ago, the Tennessee Eastman Company, Kingsport, Tennessee, a Revere customer, began to rebuild some of its copper stills or fractioning towers, which previously would have been silver-brazed. Revere's welding specialists were called in to see whether or not welding would be superior. Demonstrations were made to Tennessee Eastman engineers and shop personnel, with the result that welding was adopted. Actual experience in the shop shows a saving of 38% in materials and labor for joining, and a better job in every way. The welding method used is the inert gas shielded metal arc process.

Reconstruction of the towers was made to reduce the number of flanges. At the same time Tennessee Eastman changed from the flange joint tray construction to the inserted tray type and incidentally, reduced the number of gaskets with their accompanying maintenance problems. The trays are salvaged by shearing off the bolt hole circle and folding up the edges. The towers are some 45' high, 6' to 10' in diameter, with a tray or bubble cap plate at specified intervals. Tennessee Eastman plans to rebuilt several towers a year in this economical way.

It will pay you as it did Tennessee Eastman to look into welding as a modern method of joining copper. Remember Revere is fully experienced in the most modern and efficient methods, and will collaborate with you on their application.

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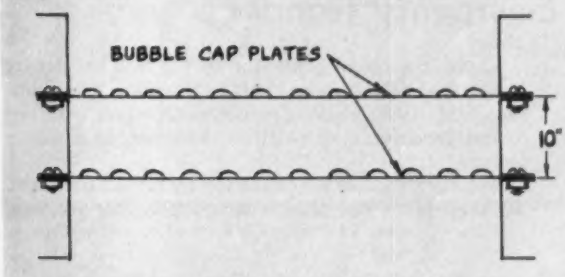
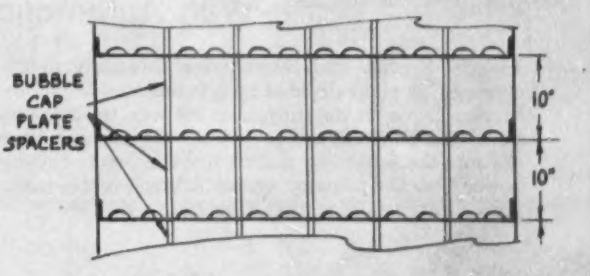
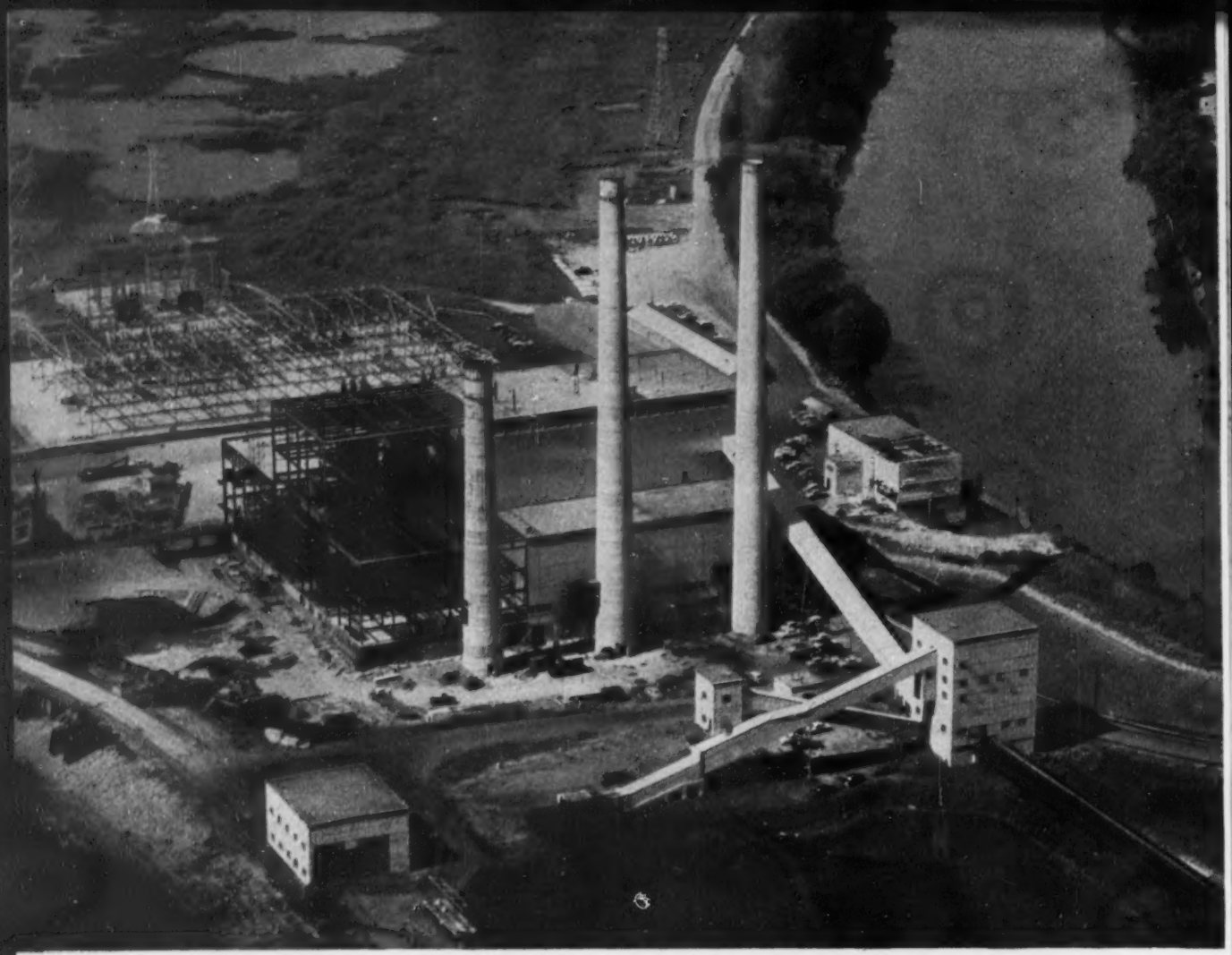


Section through old tower, showing bubble cap plates held in bolted flange.



Section through new welded tower. Bubble cap plates have had bolt holes sheared off, edges turned up. They are held in place by spacer rods.



Generating capacity of this plant is now 260,000 kw. Output goes into transmission system at 115 kv or 230 kv.

How New Upper Midwest Power Plant Assures Uninterrupted Power for Station Auxiliaries

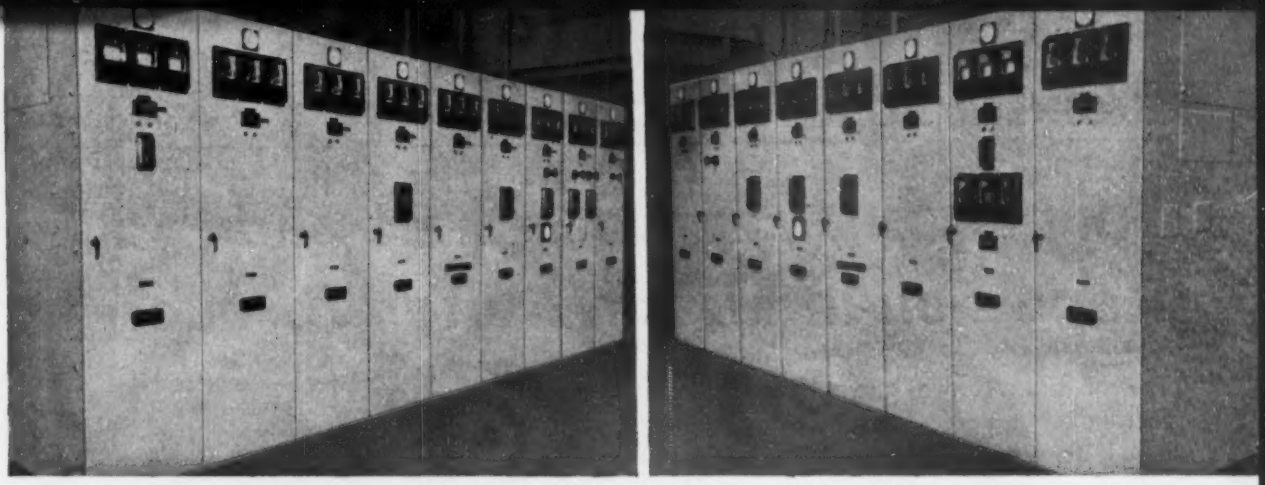
Installation Features Unit Auxiliary Buses in Two Sections With Automatic Emergency Transfer

Pioneer Service and Engineering Company in designing this plant decided on a manual make-before-break scheme on the throwover between the two sections of Allis-Chalmers switchgear. In this way they are sure the secondary source is cut in before cutting power from the primary source. A break-before-make automatic transfer is used in an emergency.

There is a house generator on the first unit only. It operates off the same shaft as the main generator, thus simplifying phasing problems. Operator is forced to use synchronizing switches, however, as a safety feature.

Auxiliary motors are protected by circuit breakers. To keep plant operating continuously, no overload

Progress In Switchgear **ALLIS-**



These two switchgear lineups face each other and are connected by bus shown at top. This group is one of three groups of Allis-Chalmers switchgear at this station.

tripping is used. An overload relay provides alarm on pulverizers and induced draft fan motors. Breakers trip only if there is a fault.

Two Switchgear Lineups

Two groups of Allis-Chalmers switchgear for each generating unit are provided along with duplicate auxiliaries. Each of these auxiliaries has excess capacity, so if one is shut down, the generating unit can still operate at two-thirds of full capacity.

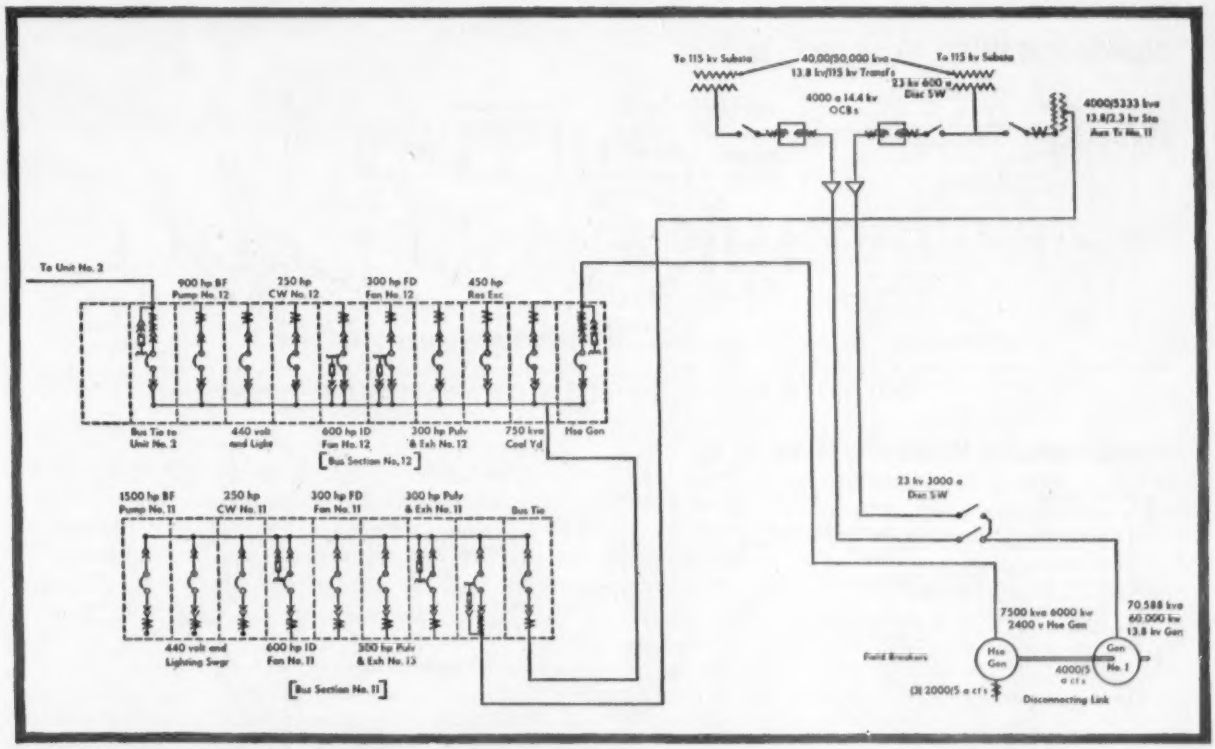
Both pulverized coal and natural gas can be used. These can be burned simultaneously in any desired proportion. This control is manual. Customary sequential interlocks in the switchgear are made with boiler control motors.

Both overload and short-circuit protection are provided by breakers on coal yard and miscellaneous circuits.

★ ★ ★

Allis-Chalmers engineers worked in close cooperation with Pioneer Service and Engineering Company and power company engineers on this interesting project. This is one of many auxiliary switchgear lineups built by Allis-Chalmers. For information, call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4449



Engineered by Pioneer Service and Engineering Company.

CHALMERS

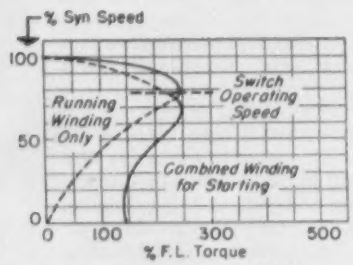
A-C ALLIS-CHALMERS

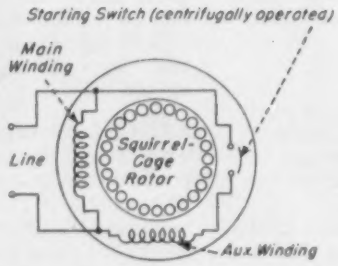
Split-Phase, Capacitor-Start and Repulsion-Induction Motor Torques

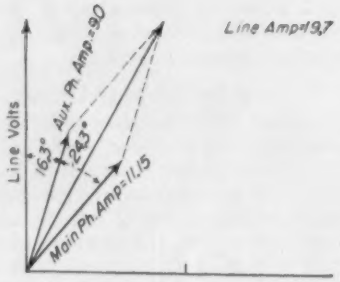
Typical speed-torque curves, connection diagrams and vector diagrams are given for single-phase, 60-cycle, single-speed, definite-purpose motors for belt-driven fans

T. E. M. CARVILLE,
Small Motor Division,
Westinghouse Electric Corp,
Lima, Ohio

Split-Phase Motors—1/6, ¼ and ⅓ Hp

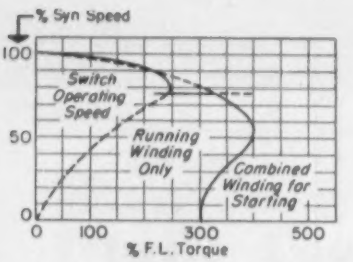


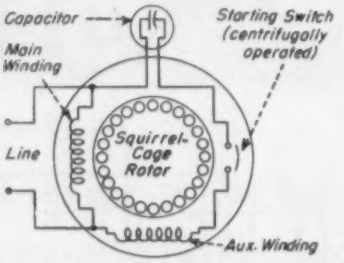


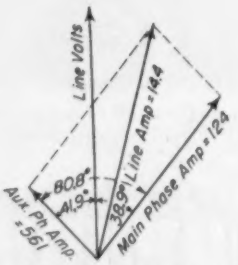


Note: Starting torque is limited by locked-rotor current restrictions, such as electric utility company regulation and NEMA standards. Breakdown torque is from 225 to 240% of full-load torque. Motor has constant-speed characteristics.

Capacitor-Start Motors—⅓, ½ and ¾ Hp

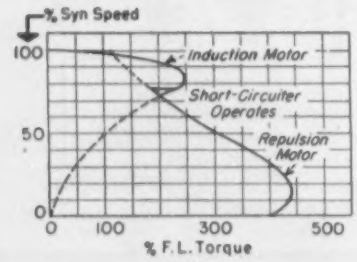


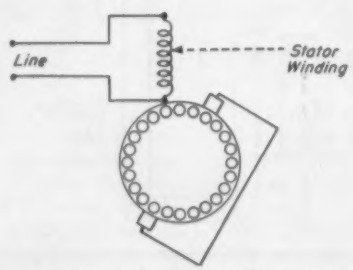


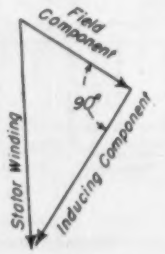


Note: Starting torque is somewhat higher than for split-phase motor because phase-angle difference between windings is greater. Breakdown torque is from 240 to 260% of full-load torque. Motor has constant-speed characteristics.

Repulsion-Induction Motors—⅓, ½ and ¾ Hp



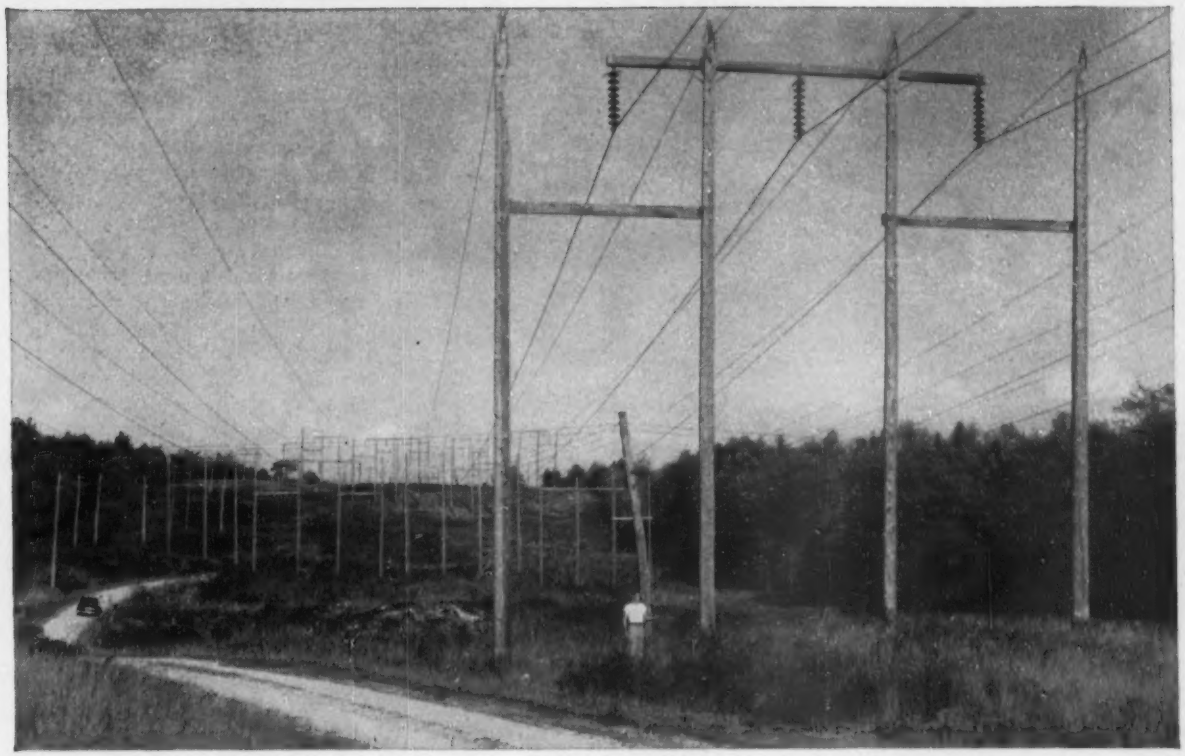




Note: Repulsion-start induction motors have high starting torque and low locked-rotor current. Motors start as repulsion motors and rotor winding is short circuited at predetermined speed so that induction-motor operation at full load is obtained. Breakdown torque is from 240 to 260% of full-load torque. Motor has constant-speed characteristics.

Torque information for split-phase, permanent-split capacitor and shaded-pole fractional-horsepower motors, also for shunt, series and compound wound motors will appear in subsequent Engineering Reference Sheets.

DOW



Sprayed right-of-way through timber-grown area, shows result of treatment with Esteron 245.

ESTERON 245 CUTS CLEARANCE COSTS

. . . is the most versatile material you can use for brush control on right-of-ways

Esteron® 245 fills many roles in a low-cost, year-around brush control program on right-of-ways and around installations. All-season spraying with this powerful 2,4,5-T ester brush killer keeps your line-cleaning crews busy and your equipment in use more months each year and saves you up to 50% over cost of hand-cutting.

Versatile Esteron 245 is useful as an over-all foliage spray in growing season and for year-around basal bark and stump treatment. Basal spraying with hand or power equipment lets you pinpoint the killing power where you want it. As a supplement to foliage spraying, basal treatment takes care of "misses" and new growths. *In any season*—even during the winter months—application of Esteron 245 in oil to the trunk base of standing brush gives good results. Used for stump treatment, it makes manual cutting more effective as a control measure. Dow sales and technical men will be glad to help you outline a year-around spraying program with Esteron 245. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

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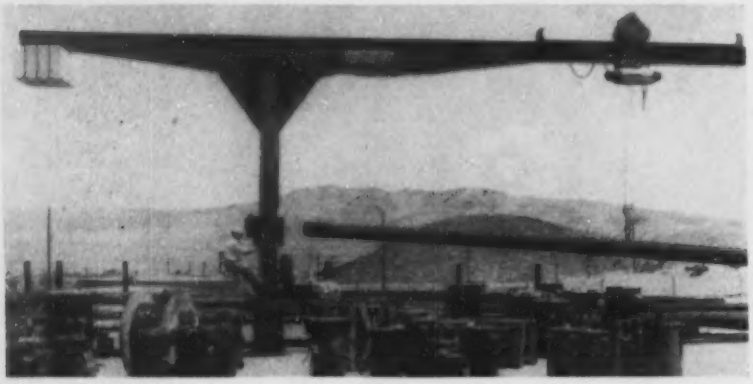
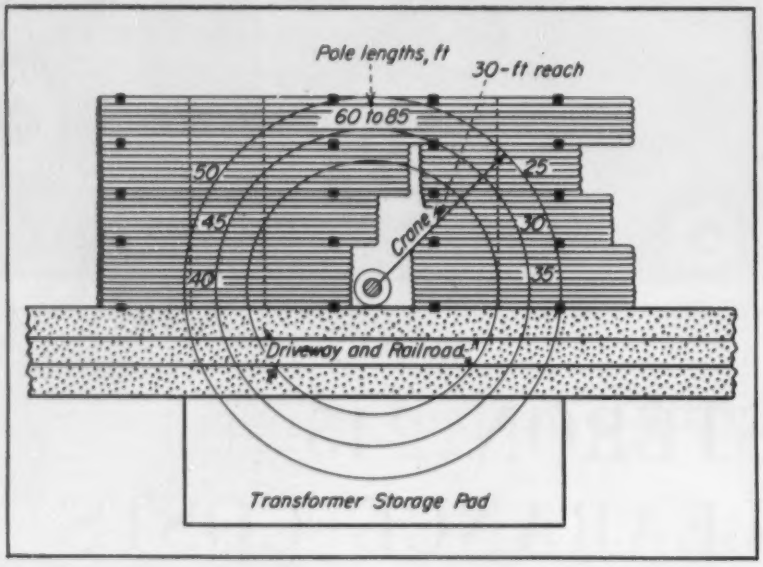
DOW

Revolving Crane Saves Storage Space:



Handles Equipment Around Its Base



JOHN MANGEL, Director, Building Maintenance and Design, California Electric Power Co, Riverside, Calif.

A two-ton pillar jib crane, used for pole handling by California Electric Power Co, Riverside, is saving money and storage space. Invented by the author to work in conjunction with a predetermined material placement plan, this "poleyard Hercules" also increases safety operation.

The crane consists of a steel pillar mounting a counter-weighted steel arm with a 30-ft reach. The arm rotates through 360 deg. A motor-operated trolley hoist on the arm provides for horizontal and vertical movement of the load. The crane has fluid drive and a two-ton lift rating with a 50% overload capability.

Two men are required to handle poles—one operating the pushbutton controls on the pillar and the other hitching poles. The crane will stack poles of any size and up to 85 ft long in a circular pattern within its 30-ft reach. By stacking poles in greater quantity and in higher bins, better use is made of pole storage space. The crane also is used to lift and store transformers, reels of wire, pipe and related valves, and fittings and tools. It can handle most transformers likely to be stored in the yard.

The first crane, installed in Barstow, Calif., has already proven efficient and valuable. Calectric has two more cranes on order and is planning for the eventual installation in all district yards throughout the system.

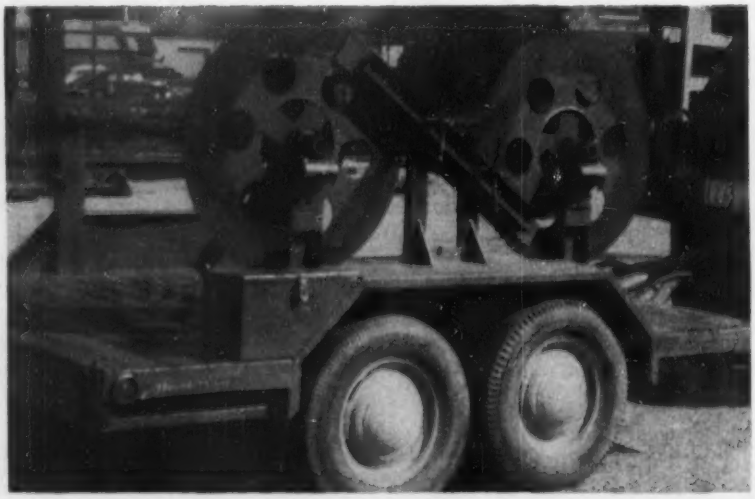
Trailer Holds Six Reels for Line Stringing

RAYMOND MOORE, Idaho Power Co, Boise, Idaho

A platform trailer having a capacity for six reels of wire makes line stringing faster and safer for Idaho Power Co. The vehicle has two reel standards from which reels may be paid out singly or all together and while the unit is moving or stopped.

The 8 x 10-ft platform frame, made of heavy channel steel, has 2-in. plank flooring and a single center axle. Single tandem 15-in. wheels with 6.50 tires and vacuum brakes provide a

(*Continued on page* 113)



We Don't Just Kiss 'em Goodbye!

Go out in the storage yard for some large construction project and, from a hundred feet away, you can pick out the suspension insulators that came from O-B. How? By the condition of their crates.

Sound crates, that stay together in the weather, may be just a detail. For sure, they don't make the insulator work any better on the line. But they *do offer* better protection and reduce breakage loss. They *do save* a lot of aggravation. They *do express* the pride a company has in getting its product onto the job in workmanlike order.

O-B crates are made on an automatic machine. It doesn't "miss" nails, or drive them crooked. Wood members are standard size and a little better quality than common crating lumber. Hand assembly, with its natural variations, is replaced by a mechanized, repetitive process. The cost of a better crate is saved by faster production. The convenience of this better crate is yours.

All of this is a far cry from laboratory research or product development which are the usual ingredients of better merchandise. Nevertheless, the attitude that good manufacturing never stops -- that no detail is unimportant -- is typical of Technical Competence, the heart of every O-B insulator.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

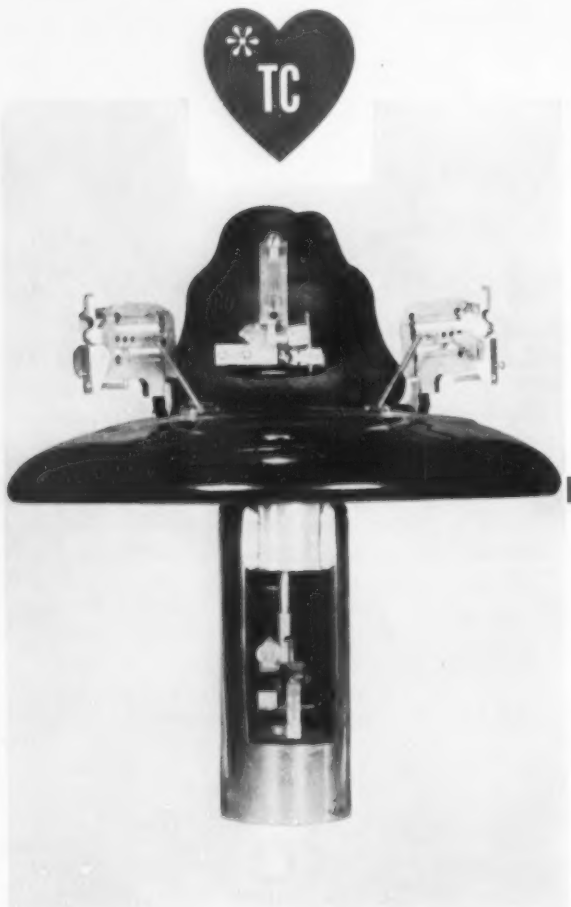
TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

Where Life or Death May Be Only 1/100,000 of an Inch Apart

Strain on a suspension insulator produces minute but very significant movement of parts -- movement of the cap and of the pin in relation to the porcelain head. These react as mechanical stress on the porcelain dielectric. What are these movements? What is their extent? What strains do they produce? What is their relation to insulator life? How can they be favorably influenced?

These questions occupied over five years of concentrated laboratory research into the pure Mechanics of a suspension insulator; recognized by technical societies as the most complete and exhaustive investigation ever conducted on this subject. Out of this test project came many basic laws of insulator behavior, many guides to design, many contributions to longer service life. One would naturally expect to get more out of an O-B suspension insulator -- so much more has been put into it!

This extra ingredient that has added vastly to value, but nothing to price, is Technical Competence, the heart of every O-B insulator.



Tensile test machine with specimens under observation. Five separate gauge positions are utilized. In addition to ordinary mechanical movement under tension, there is another whole category of movement caused by thermal change. These two sets of forces were studied separately and in combination. Where temperature control was involved, the specimen was encased in insulating material with the illuminated optical tubes inserted through the walls. Under these conditions, temperature control extended from 140° to -30° F.

Basis of an investigation of the almost microscopic movements in an insulator is a proper gauge. It became necessary for O-B laboratory technicians to devise a highly improved and refined version of the best available precision instrument. Working on the principle of multiplying levers activating a system of prisms, the "cube-corner" law of refraction utilized the wavelength of light to provide a fixed scale to make visible measurements of substantially less than 1/100,000 of an inch. Such gauges were attached directly to portions of the specimen where physical load might produce mechanical change. This involved entry into several internal areas of the insulator. Specimen preparation, itself, was a complex and exacting undertaking.

DIGEST OF FINDINGS:

Strain on a suspension insulator is transmitted to the porcelain in a complex group of forces, predominately of a compressive nature. In order not to exceed the compression strength of this material, the various parts must completely recover to their normal condition on the termination of an excessive mechanical load. Lacking this ability to recover, recurring strains have a cumulative effect leading to a shortening of insulator life. Control of primary forces falling on the porcelain, and of the ability of parts to recover, is a function of interrelated cap and pin design plus many assembly techniques. Fundamental laws of insulator behavior were established and have been fully exploited in the present O-B commercial product.

TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

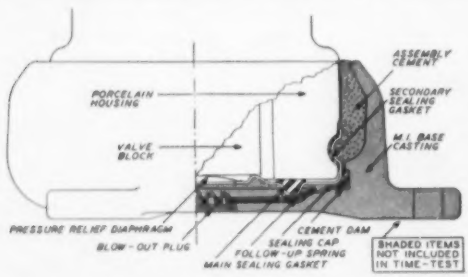
This Super-Turkish Bath Proves Out Thorex Arrester Seals

If moisture enters the interior of a lightning arrester, electrical stress will act to produce an acid that can damage gap elements and make power-follow current interruption unreliable. Therefore, a positive and permanent seal is essential.

This is assured in the Thorex arrester by means of constant dynamic loading of the main sealing gasket through action of a follow-up spring which compensates for any possibility of "set" or migration of the gasket material. But when we *test* the seal, this reenforcing spring pressure is omitted and the main gasket must act without assistance.

A testing cycle requires one week: three days at 160° F., with 95 to 100 per cent humidity, followed with four days of ordinary air temperature (60° to 90° F.) with 100 per cent humidity. Full operating voltage is continuously maintained on all specimens.

Sixteen random-selected units from factory production have passed more than a year of this punishment -- the equivalent of several life-times of ordinary service -- and remember, with only about half the effective seal of an operating unit!



Devising and conducting a test such as this is a commonplace laboratory procedure, although it does require space, equipment, and facilities. Here, the product itself -- designed with great safety factors, where safety counts most -- offers a clear demonstration of Technical Competence, the heart of *every* Thorex lightning arrester.

OHIO BRASS COMPANY, MANSFIELD, OHIO

In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

Looking into the doorway of the heat- and steam-chamber where Thorex arrester seals are under repetitive cycles of temperature and humidity. The laboratory technician is checking the chart that records atmosphere within the room.

Interior of the test chamber during the saturated steam cycle. Portions of the horizontal heat exchangers can be seen behind the arresters on test. At all times, full voltage is applied to all specimens.

the heart of <u>every</u> Ohio Brass arrester

4415-H

Line Stringing

(*Continued from page* 108)

smoother ride, greater capacity and help over high centers. The trailer bed is 2 ft above the ground.

Two reel standards are 26 in. off the floor and 25 in. on each side of the axle. Each standard has an individual friction brake consisting of two steel channels back-to-back on a welded mount. On the inside of each end of both channels are brake shoes that bear on either side of the braking disk. Brakes are operated by spring-tensioned handles, one for each standard. All three reels on each bar may be operated singly or locked together. Reels handle up to 4/0 conductor.

Usually during stringing on energized lines, wires are pulled one at a time. When one reel is empty the brake is applied, and the conductor is held with a sling and grip while being spliced to the next reel. Two men can handle this stringing operation. The trailer usually is anchored to a vehicle during the stringing but may be anchored to a pole or ground pins.

On hard surfaces, the trailer can be hauled fully-loaded by a ½-ton pickup truck. A larger vehicle with 4-wheel drive or a small crawler tractor may be necessary over rougher terrain. The trailer has replaced more expensive equipment formerly used for wire stringing. Experience has shown the new unit provides faster and safer operation than past methods.

Recloser Indicator Is Visible Day and Night

FRANK MOORE, Substation Maintenance, Ohio Power Co, Portsmouth, Ohio

A new position indicator avoids loss of time in locating locked-out reclosers. It does not hinder recloser operation and can be easily seen from the ground either day or night.

With the recloser-position indicator pole climbing is reduced, time is saved in trouble-shooting, and hazards of climbing poles after dark are reduced.

The indicator was made by mounting a copper strap in place of the old target, using the same screw holes. Its face has been enlarged from ⅝x⅞ in. to 2¼x1 in., being made from one piece of 1x5½-in. copper strap, bent for attachment.

(*Continued on page* 116)

How to have clear telephone service... even in the middle of the proverbial "BOILER FACTORY"!

GAI-PHONE (pronounced GUY-phone) *... the wonderful new electronic telephone for noisy areas*

EVER TRY to talk to your chief engineer while he checked meters at a generator? Or to your production manager while your biggest and noisiest machinery ran full-blast? Such a situation *could* be no problem at all, if your man were talking to you on a GAI-PHONE.

This ingenious electronic telephone—using some vacuum tubes, rectifiers and other devices in its special base—actually creates a *Zone of Quiet* around the user's head. His voice comes through clear as a bell, but the extraneous noise is effectively suppressed. What's more, he can adjust *his* telephone so that your conversation is clearer and the annoyance of side-tone is reduced.

Best of all—it's all much less expensive than building sound-proof booths or such. Let us tell you more—send coupon today.

STROMBERG-CARLSON®

TELEPHONE DIVISION • ROCHESTER 3, N. Y.

Please let us have more information on your GAI-PHONES, for use in noisy areas.

FIRM .....

ADDRESS .....

.....

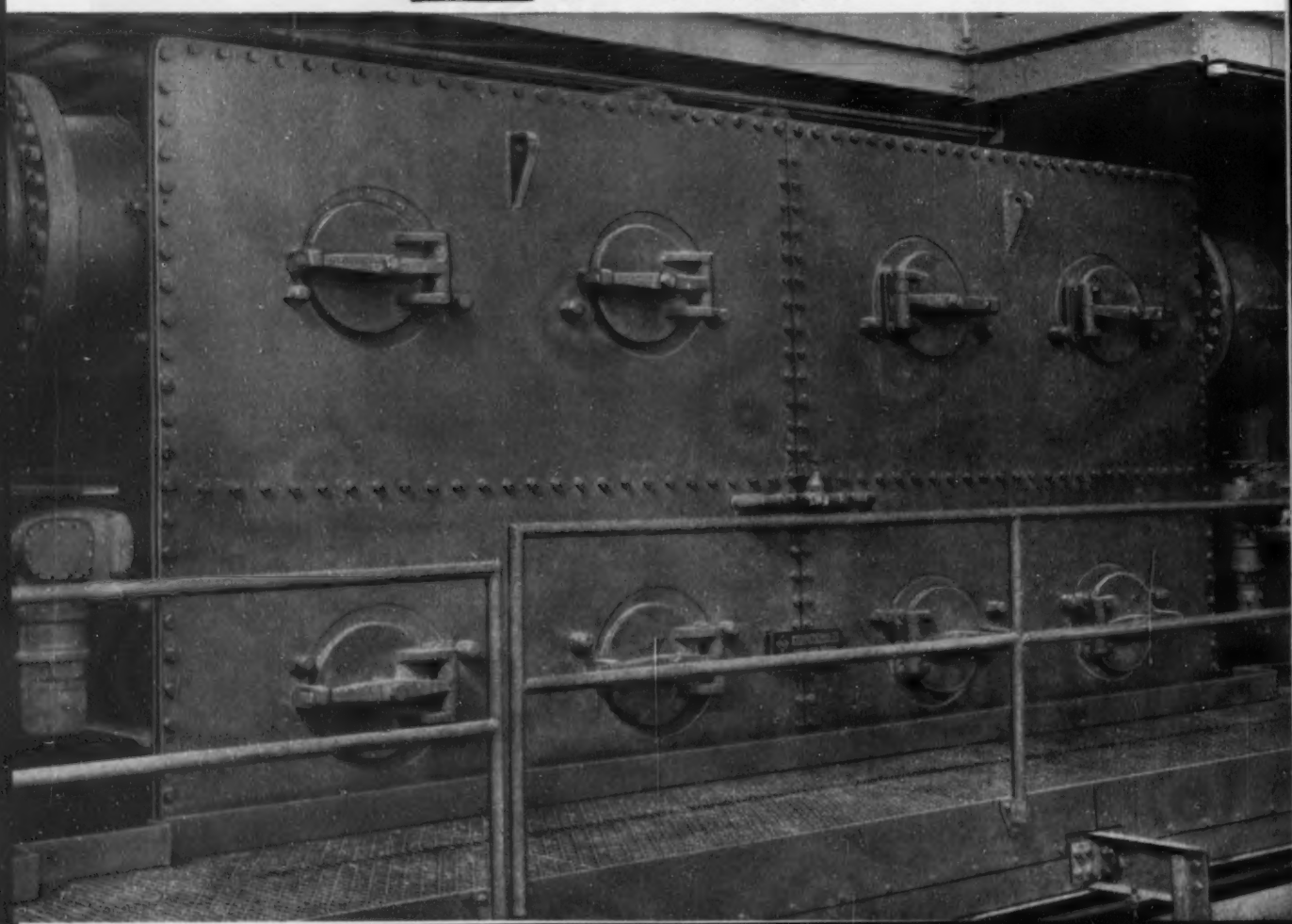
SIGNED .....

Choice of condenser shapes . . .

Rectangular,

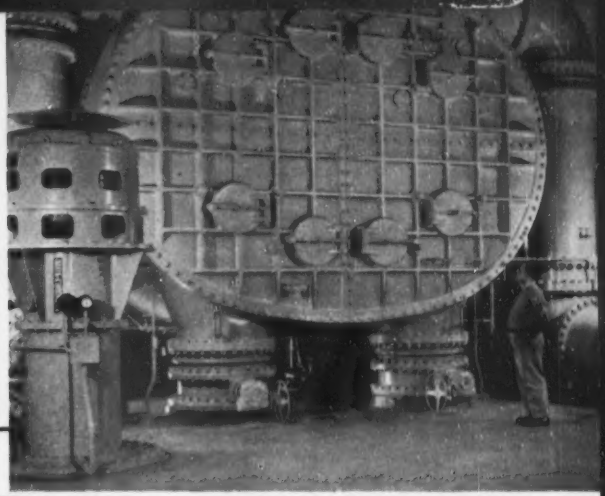
For complete flexibility in power plant design, Allis-Chalmers condensers are built with steel or cast-iron water box, and in shapes to meet any space requirements

Rectangular Allis-Chalmers 50,000-sq-ft, two-pass, divided water box surface condenser.



Oval and Round

ALLIS-CHALMERS
Custom-Engineered
CONDENSERS



Oval condenser helped this power plant get greater utilization of space. Unit is a 45,000-sq-ft, two-pass surface condenser.

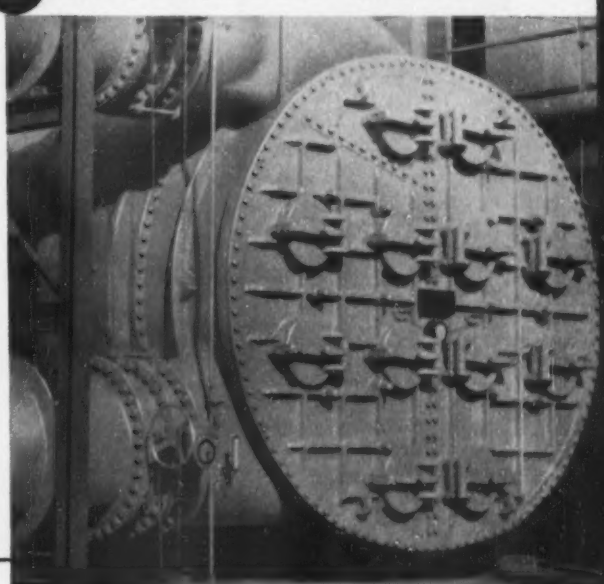
As a leader in building condensers, A-C is familiar with all problems of custom-engineering a condenser to meet unusual space requirements. In addition, Allis-Chalmers production facilities are set up for routine handling of any type or size unit.

GET ENGINEERING HELP

A-C will cooperate with your engineers to help you get top efficiency — in terms of condenser performance — as well as greater overall value for all your power plant dollars. Contact your district representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4393

Round 35,000-sq-ft, two-pass side steam inlet condenser.

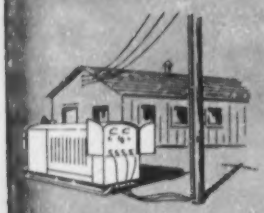


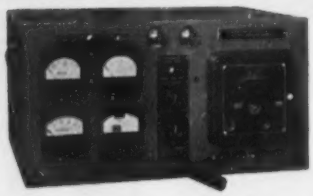
A-C ALLIS-CHALMERS

ALLIS-CHALMERS

ELECTRIC CONTROLS by Lake Shore

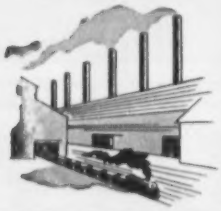
GENERATOR CONTROLS





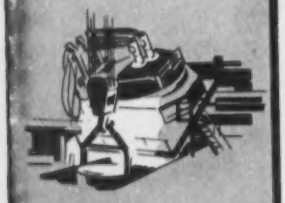
Both A.C. and D.C. units can be engineered and built for engine generator manufacturers. Portable or fixed-installation models are available for industrial applications or to government specifications for military projects.

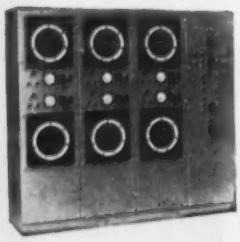
MOTOR CONTROLS



Heavy-duty totally enclosed controls can be designed and fabricated for industrial, marine, power plant, machine tool and specialized applications. Single or multiple motor control assemblies are produced to J.I.C., NEMA, AIEE No. 45, U.S.C.G., A.B.S. or Lloyds specifications as required.

PROCESS CONTROLS





All types of automatic control systems can be custom-built for industrial processes such as metal forging, oil refining, food processing, rubber compounding, water treating, etc. These units are designed to provide for control and/or recording of flow and time factors.

UNIT SUB-STATIONS LAKE SHORE can supply a variety of switchgear utilizing pre-engineered standard components and appropriate transformers to meet a wide range of requirements. Capacities range from 2400 to 14,400 volts and from 25 to 2,000 KVA.

Write today for catalog ▶

1968-LS

Lake Shore

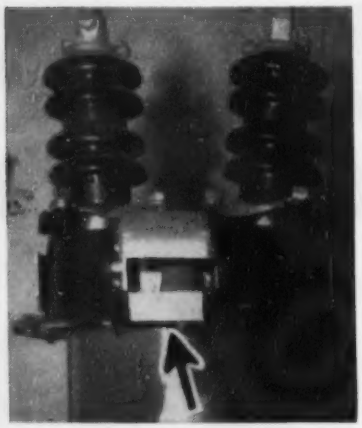
ELECTRIC CORPORATION

225 WILLIS STREET • BEDFORD, OHIO

ENGINEERS • DESIGNERS • FABRICATORS

Recloser Indicator

(*Continued from page* 113)



MODIFIED INDICATOR is visible on recloser in open position, as shown, invisible closed

The face is covered with red reflecting tape, although any color of tape may be used. Essential requirement is that the target reflect distinctly when any light, flashlight or spotlight beam, strikes it.

When the mechanism is closed, the indicator cannot be seen. When open the target is easily visible.

The modification was made with small expense as the target was fabricated in about 20 min.

Portable Unit Finds Grounded DC Circuits

H. A. DILBERGER, Senior Electrical Engineer

PAUL HUNT, General Foreman, Pacific Gas & Electric Co, East Bay Division, Oakland, Calif.

Locating grounded dc circuits in power stations is a simplified, one-man operation with a portable ground detector developed by Pacific Gas & Electric Co.

The instrument consists of a zero-center milliammeter calibrated in ohms, suitable resistors with a center tap for grounding, two toggle switches, and portable leads and clips. The device is arranged for use on 125/250-v dc circuits. It may be used on other dual-rating circuits of lesser voltage.

The detector scheme replaces the former practice of one man standing at the ground-indicating device at the main switchboard while another man opens and closes circuits. Aside from requiring two men, the old method was

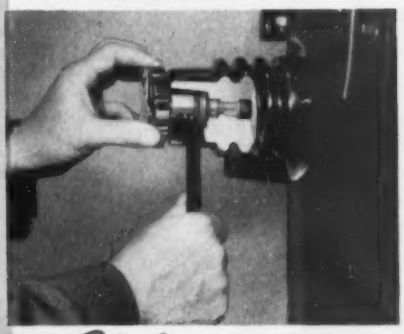
Pole Star .. BEST BY FAR

3 more reasons why . . .

1 — The Pole Star CORE AND COIL UNIT CAN BE TAKEN APART AND REBUILT

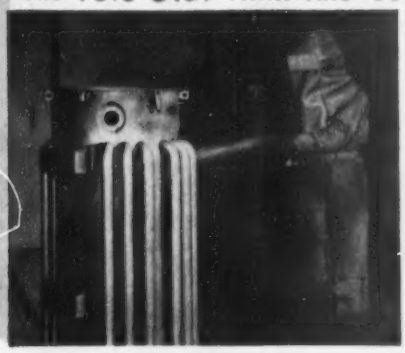
If a coil is damaged by lightning or excessive overloading, cores can be taken apart and rebuilt with replacement coils. This can be accomplished without appreciably affecting the low core loss or low exciting current of the Pole Star.

2 — The Pole Star SIDEWALL BUSHINGS ARE ELECTRICALLY CO-ORDINATED



The Basic Impulse Level of each bushing is co-ordinated with the transformer windings. When the transformer is subjected to a voltage surge above the BIL of the bushing, the bushing will flashover on the outside. A separate, completely co-ordinated bushing is available for each voltage class — 5 Kv and 8.6 Kv.

3 — The Pole Star TANK AND COVER ARE SHOT BLASTED *THEN* PAINTED



Three coats of transformer paint are individually applied and individually baked onto the tank *only after* the tank is cleaned with steel grit to positively remove scale, grease and dirt from the tank surface.

Pole Star Transformers are available in a complete range of distribution sizes — 3 to 500 Kva, 2400 through 67,000 volts. For detailed information, write to Pennsylvania Transformer Company, Box 330, Canonsburg, Pa.

PENNSYLVANIA TRANSFORMER COMPANY
A McGRAW ELECTRIC COMPANY DIVISION
CANONSBURG, PA. • ***Greater Pittsburgh District***

HAS YOUR LIGHTING KEPT PACE WITH PROGRESS?

You're always ahead with Sylvania Fluorescent Lamps because of Complete Versatility

You can obtain Sylvania lamps in every diameter, type, and size you need. You can also have them in many color tones to add eye-appeal to your merchandise, or to bring an abundance of natural light to offices and stores. Also, you can have Sylvania lamps that start *quickly* . . . or *instantly!*

Remember, Sylvania Fluorescent Lamps must assure you of complete satisfaction or your money back.* See them at your Sylvania dealer's today!

*Try 24 Sylvania Fluorescent Lamps of any popular type. If, in your opinion they don't give more light and maintain color and brightness for a longer time than any other brand, send them back with your signed Certificate of Assurance and your money will be refunded.

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., St. Catherine St., Montreal, P. Q.

LIGHTING • RADIO • ELECTRONICS • TELEVISION

GROUND DETECTOR requires one man and simple procedure to find grounded dc circuits

cumbersome when circuits some distance from the main board were being checked.

To locate a ground with the portable detector, one man takes it to the spot where he may sectionalize circuits or isolate them individually. With the instrument connected across the line and to ground, the operator can open circuits and watch the resistance pointer. When the instrument finally reads infinity, the grounded circuit has been located.

"Shorting" Device Assures Safety for Linemen

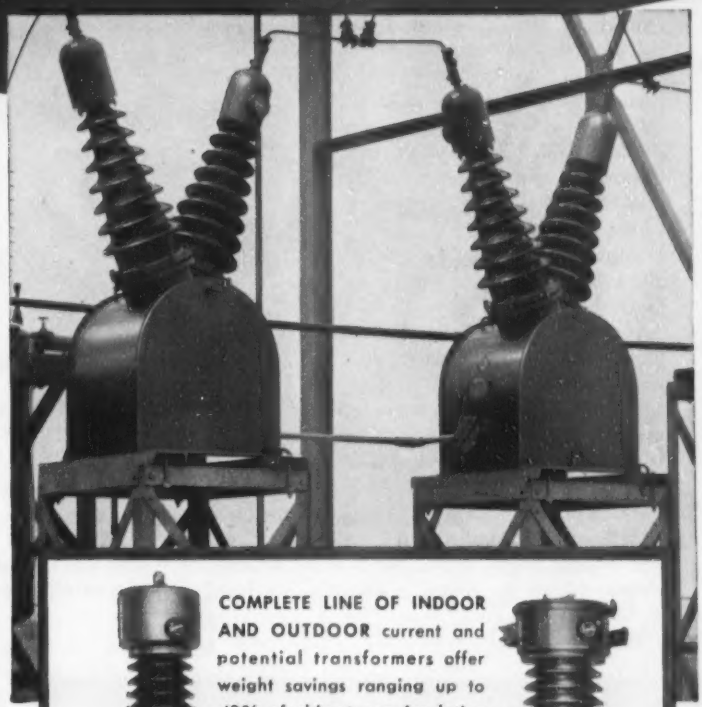
Safety of linemen engaged in application of standard ground clusters and cables on high tension lines is assured by a new short-circuiting device used by Northern States Power Co. The device does not ground the line but it does short circuit phases. If there is potential on the line this will cause a breaker to open or a fuse to blow or there will be an arc, flash, or visual indication at the point of the short.

Short circuiting device is easy for the crews to use. It consists of 11 ft of special link chain and 135 ft of nylon rope, having excellent dielectric characteristics. The chain is attached to the rope with connectors.

One end of the rope is thrown over the line so that it comes back to the ground. Then the ends of the chain are fastened with detachable connectors to the ends of the rope, and by pulling the rope the chain is drawn across the phases of the line without endangering workman. The rope is pulled up so as to furnish a positive contact with each phase.

These potential transformers weigh 800 lbs less than older types

SAVE TIME...SAVE SPACE ...SAVE STRUCTURE



ALL THAT IS NEEDED to lift these 69-kv potential transformers into place is a set of rope blocks — thanks to the savings in weight made possible by new Allis-Chalmers designs. In addition, they take up less space, require less foundation structure than other types of potential transformers.

Corona-Free Design Provides High Insulation Strength

The units are corona-free. They have high insulation strength and high thermal ratings. Long-time overvoltage tests have proved all voltage classes.

Construction Sturdy

Tanks are all-welded, hermetically sealed to protect insulation and oil from sludge formation. Unique bushing construction permits circulation of oil through the bushing and transformer, reducing oil requirements and permitting reduced transformer sizes.

It will pay to get all the facts on weight savings and quality design and construction of Allis-Chalmers current and potential transformers. For your copy of the technical paper "PT's Are Getting Smaller," consult the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4483

COMPLETE LINE OF INDOOR AND OUTDOOR current and potential transformers offer weight savings ranging up to 40% of older types. Insulation strengths are greater and thermal ratings higher than could previously be provided.
High Voltage Potential Transformer
High Voltage Current Transformer

ALLIS-CHALMERS

INDUSTRIAL APPLICATIONS

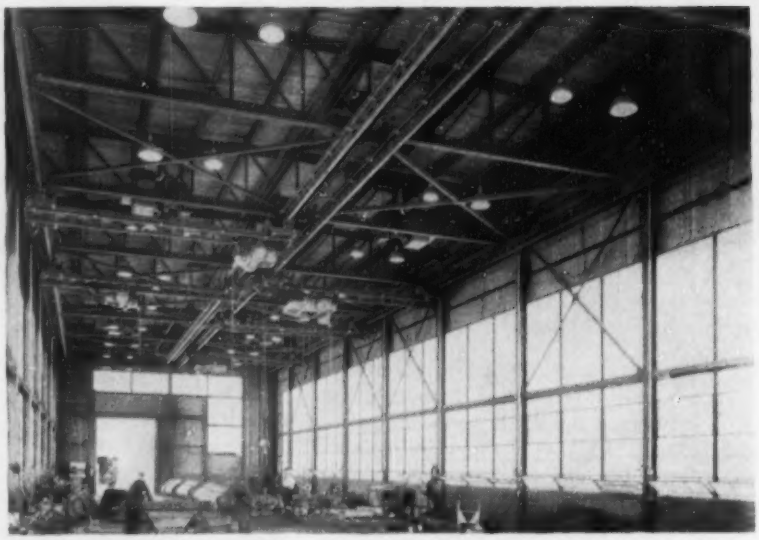
High Level "Mixed" Lighting Ups Production, Cuts Accidents

FRED R. LEFFLER, Electrical Design Engineer, Weers Electrical Planning Service, Denver, Col.

A combination of mercury vapor and incandescent lamps in high bay aluminum reflectors at the new addition to the Card Iron Works, Denver, Col., has solved the problem of high level, high efficiency lighting for eliminating the "strobe" hazard of rotating machinery. Production has been increased and accidents have been cut remarkably in this new addition, according to Dave C. Card, company president. The morale of the concern is centered around the new addition, says Mr. Card, since "everyone wants to work there."

Alternate units are connected to alternate phases of the 3-phase supply to further reduce "strobe" effect, by "overlapping" of ignition and extinguishing arcs of adjacent mercury vapor lamps. Each 16 by 21-ft bay has a 400-w, 16,000 lumen, AH-1 mercury vapor lamp unit together with a 500-w, PS-40 incandescent lamp unit. Luminaires are 25 ft above working plane.

A fluorescent lamp lighting system was originally considered, but it was abandoned for the following reasons:



HIGH BAY combination mercury-vapor and incandescent lamp reflectors provide 30 ft-c color corrected illumination to increase production and reduce accident rate in iron foundry. Stroboscopic effect of mercury vapor units and hazard of rotating machinery is reduced

1. 160 two-lamp fixtures would have been required instead of the present 40 luminaires — with much higher initial cost.

2. Because of fewer units, maintenance of the mercury vapor and incandescent system was more likely to be handled on a schedule than was the fluorescent system.

The color correction of the inherent bluish mercury vapor light is offset very effectively by the mixture with the incandescent light. This installation has 62 percent mercury vapor and 38 percent incandescent lumens mixed.

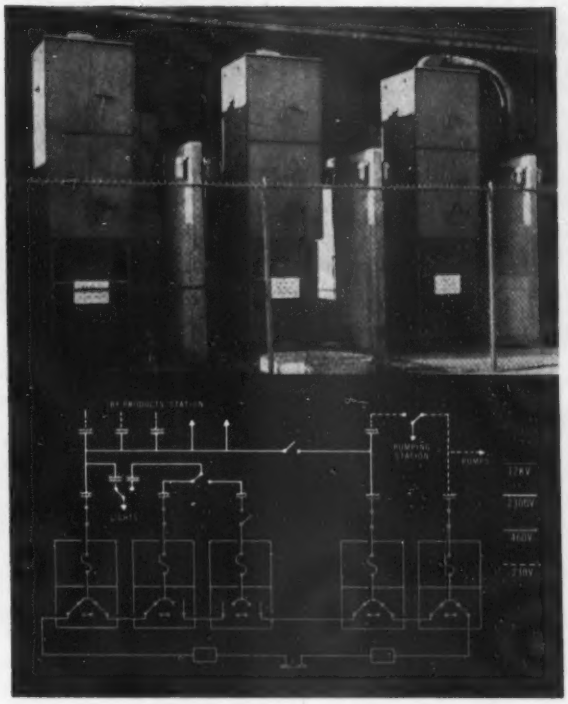
Abrasive Cleaning Improves Finish of Castings

Blast cleaning by airless abrasive method in automatic tumbling machine at Adalet Mfg Co, Cleveland, Ohio achieves a uniform and lustrous finish on sand-cast aluminum electrical castings. Parts weighing from a few ounces up to approximately 5 lb are cleaned in 5 min by one operator who cleans about 1,200 lb of castings part of each day. He operates other machinery the rest of the time. The blast cleaning removes all clinging sand and burned-in dirt. Ground areas are deburred. Grounding lines are blended out and the shininess on ground areas is removed. Result is a uniform aluminum-type lustre all over the casting.

(*More Industrial on page* 122)

Greater FLEXIBILITY at a Lower Cost

A large gas plant saved thousands of dollars by using G & W Type "RAL-SC" Switch Fuse Units as primary switchgear!



Where power failure might disrupt essential service to thousands of gas consumers, Type "RAL-SC" switch fuse units were used to connect two electric utility feeders in a 12 Kv. loop supplying five 1500 Kva. transformers and one 450 Kva. transformer.

The diagram shows the system layout which provides alternate power to the various loads operating at 2300, 460 and 230 volts.

Each of the 12000/2300 volt transformers can be connected through an "RAL" oil switch to either of the two utility feeders. Fuse protection for each transformer is furnished by Type "SM" power fuses located in the middle cabinets above the "RAL" oil switches. Isolating disconnects are in the top cabinets above the fuses.

The "RAL-SC" units are fully enclosed in welded steel compartments installed outdoors. Operating shafts of the "RAL" switches extend back through the building wall and are operated from the inside. Cabinets are interlocked with the oil switches so the fuse enclosures cannot be opened when either feeder is connected to the load circuit.

Send an outline of your switch-fuse problems for G & W recommendations.

G&W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois, U.S.A.
Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

D544

The Old Reliable

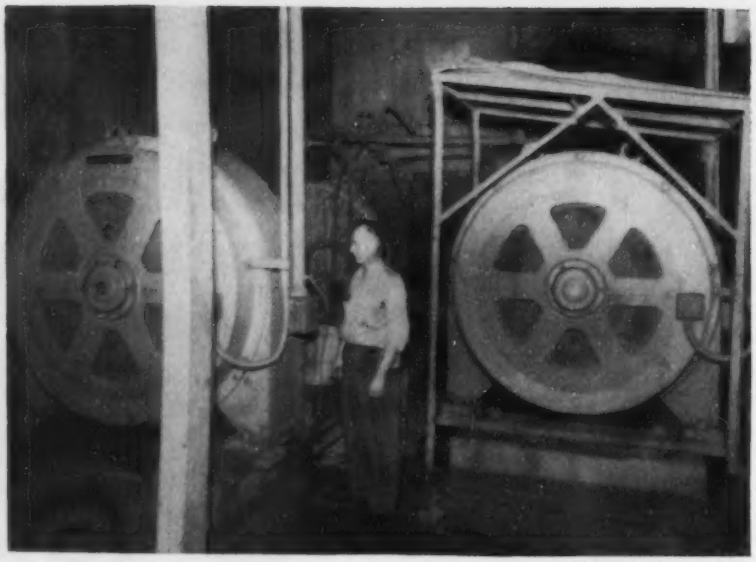
EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA



Fairbanks, Morse & Co

SYNCHRONOUS MOTORS raise plant's over-all power factor from 80 to 86%, well above the penalty range. The 600-hp motors drive a pair of 12-in. centrifugal pumps which handle 446,400 gal of waste tailings per hour

Costs Cut $500 By Synchronous Motors

Installation of two 600-hp synchronous motors has raised the power factor for four iron ore concentrator plants operated on the Mesabi iron range out of the penalty range with savings of $500 monthly. The two motors have lifted overall power factor from a low of 80% to an 86% level, safely over the 85% penalty limit specified in the company's power contract. Voltage regulation has been improved and the available transformer and distribution capacity has been increased.

Before the synchronous motors went into service, all equipment in the four plants was powered by induction motors ranging in size up to 250 hp for the pumps. Normal load averaged 6,000 kw and energy consumption was 3,000,000 kwhr monthly.

The synchronous motors replaced two induction motors in one of the plants. Although these units operate alternately, they were sufficient to bring power factor for the entire four-plant system up to 86%.

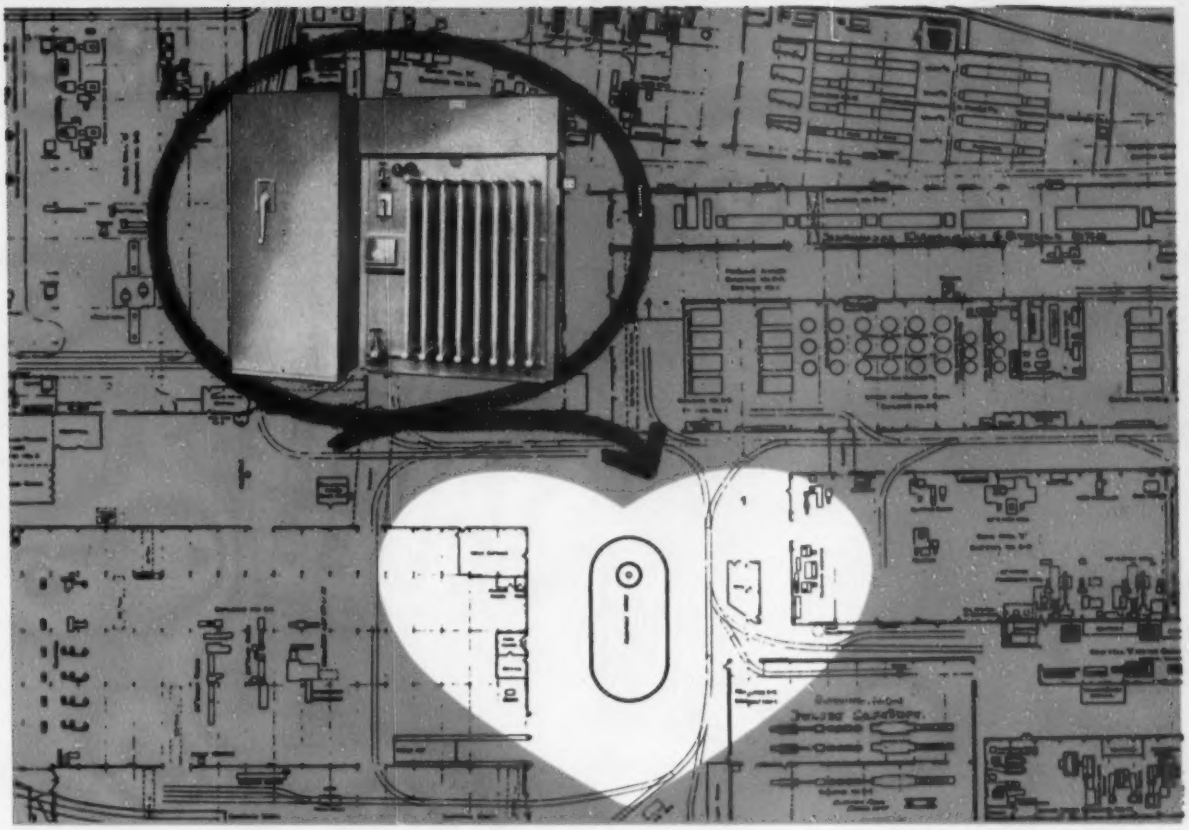
The motors are designed to operate at constant speed under all load conditions. Each is rated 600 hp, 600 rpm at 80% leading power factor. The power supply is 3-phase, 60 cycle, 2,300 v.

Each of the synchronous motors drives directly a 12-in. centrifugal pump designed to handle material containing 25% solids. These pumps take turns pumping waste tailings through 7,700 ft of 18-in. pipe leading from the plant to the company's huge tailing basin located ¾ mile away. Although 5,000 ft of the flow is by gravity, the pumps have a static lift of 76 ft and operate with a discharge pressure of 90 to 100 psi. Normally they handle 446,400 gal an hour, the solids amounting to about 450 long tons per hour.

Mirrors Beveled

Beveling glass mirrors at the Brin Glass Co, Minneapolis, Minnesota with two electrical aids, increases production to 700 80 in. wide mirrors a day. A 27-hp machine of the fast-driving type bevels the mirror edges. After mirrors are thoroughly washed, they go on a conveyor belt where a fan spray removes excess water by air pressure. They are then silver sprayed and pass into a heat zone having radiant infrared units. When they emerge from this heat zone a second protective coating is sprayed on and they pass into a second infrared heat zone. After air cooling they pass into the packages for shipping. A. W. McNabb, Power Sales Engineer, Northern States Power Co.

(*Industrial Briefs on page* 126)



In the "heart" of your plant...

an UPTEGRAFF LOAD CENTER TRANSFORMER

reduces costs...improves power characteristics

Uptegraff announces a complete line of *Liquid Filled* LOAD CENTER TRANSFORMERS—150 KVA to 2500 KVA, 3 phase—designed for convenient installation with various types of switching equipment and terminal arrangements.

The use of Uptegraff Load Center Transformers offers savings up to 15 per cent as compared to the practice of using remote outdoor transformers to supply low-voltage power to machines and equipment located indoors. With load center transformers, costly low-voltage runs are kept to the minimum, and power characteristics are improved.

Uptegraff Load Center Transformers are designed and built specifically for this class of service. In addition to savings in installation costs, they offer substantial economies through operating efficiency. They are dependable and require the minimum of maintenance.

R. E. Uptegraff Manufacturing Co.

Scottdale, Pennsylvania

NEW HANDBOOK

The new Uptegraff Load Center Transformer Handbook simplifies the selection of a suitable unit, including auxiliary terminal equipment to provide the facilities you require. It gives overall dimensions and weights (including terminal devices, etc.) for all ratings from 150 to 2500 KVA,—3 phase. Write for a free copy. The coupon below is included for your convenience.

R. E. Uptegraff Manufacturing Company
Scottdale, Pennsylvania

Please send a copy of your LOAD CENTER TRANSFORMER brochure, Catalog 132, to:

Name _____ Position _____

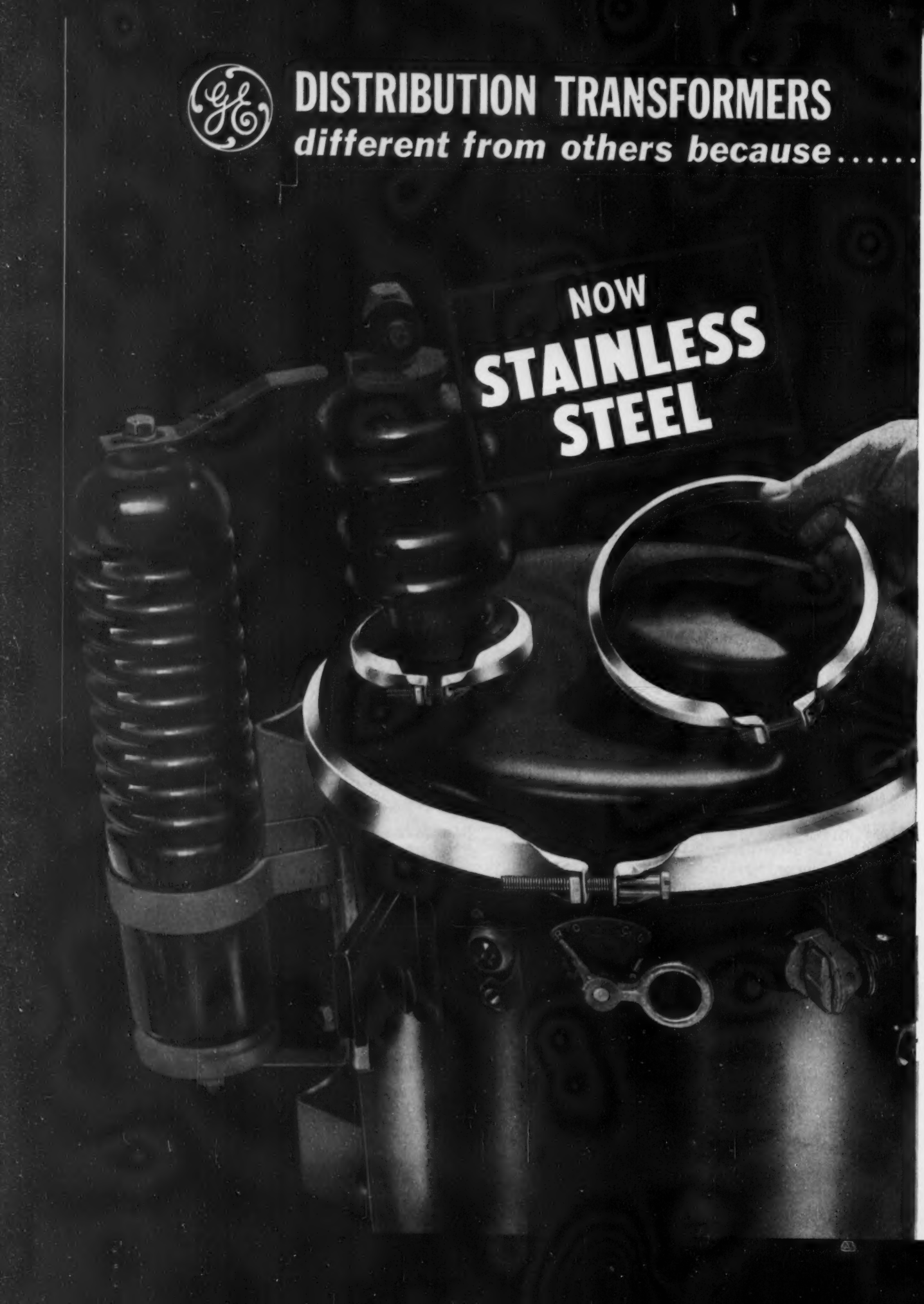
Company _____

Address _____

EW-11

DISTRIBUTION TRANSFORMERS

different from others because.....



...Stainless Steel Clamping Bands

prevent rust and corrosion . . . easy to put on and take off

One-piece cover bands on cover, handhole cover, and bushings of General Electric distribution transformers are easy to remove for inspection or maintenance—and are just as easy to replace. Only a screwdriver is needed to loosen or tighten the one bolt which holds each band in place.

Exerting even pressure on nitrile gaskets, the clamping bands assure an airtight seal. This prevents oil contamination even after years of service and results in longer transformer life.

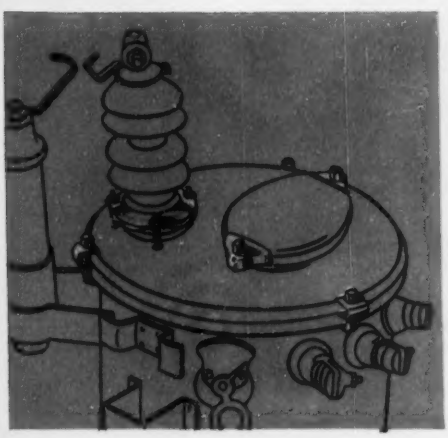
CORROSION IS GREATLY REDUCED by this new G-E design which eliminates bolt clamps and welded projections which can trap moisture and thus cause corrosion. In addition, all G-E bands and bolts (plus Belleville washers on the cover and low-voltage terminal clamps) are made of *stainless steel* to prevent corrosion. (The bands, however, are painted blue-gray to harmonize with the tank.) A coating of Neoprene rubber is vulcanized to the inside of each band to prevent its scratching the tank or cover and starting the corrosion cycle.

REMEMBER . . . all transformers are not alike . . . compare them all and see for yourself why General Electric is your best transformer buy.

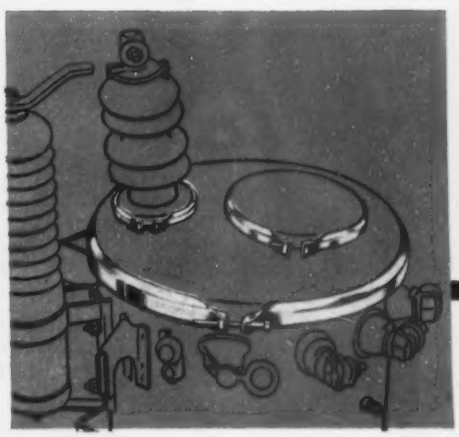
For more information on distribution transformers, either self-protected or conventional, contact your nearest G-E Apparatus sales office or agent, or write to General Electric Company, Section 431-16, Schenectady 5, New York.

Progress Is Our Most Important Product

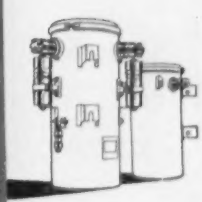
GENERAL ELECTRIC



ORDINARY COVER with bolt-clamps and other projecting surfaces of ordinary carbon steel offers many spots for rust and corrosion to set in.



NEW G-E COVER with its stainless-steel clamping bands has a clean, functional design that gives maximum protection against corrosion.



SELF-PROTECTED CONVENTIONAL

"Take your choice G.E. makes both"

Quick, dependable carrier measurements—3 to 500 kc

New Model 104 Carrier Frequency Voltmeter—5 to 150 kc

Four Frequency-Selective Voltmeters

Four precision frequency-selective voltmeters for carrier system measurements are now offered by Sierra. Including the new Model 104, these instruments cover all frequencies 3 to 500 kc. They provide a fast, accurate means of measuring voltages in telephone, telegraph, telemetering and control circuits. They also make possible quick, dependable tracing of circuit faults. All four instruments have direct reading meters calibrated in dbm from −20 to +2 dbm on the meter and −60 to +40 dbm on the range changing attenuator. All contain a built-in calibration oscillator and a VTVM for swift, simple calibration. **For details, request Bulletin 107.** *(For wave analysis and harmonic studies 15 to 500 kc, Sierra offers Model 121 Wave Analyzer. Request Bulletin 103).*

SPECIFICATIONS

Model No.	Frequency Range—kc	Input Level Range—dbm	Selectivity		Direct Reading in dbm	
			Down 3 db	Down 45 db	Balanced	Unbalanced
101A	20—500	−80 to +42	± 750 cps	± 6000 cps	*	600 ohms
103A†	3—40	−80 to +42	± 400 cps	± 3000 cps	**	600 ohms
104	5—150	−80 to +42	± 300 cps	± 1500 cps	**	600 ohms
108A	15—500	−80 to +42	± 600 cps	± 3000 cps	135 ohms*	600 ohms

*May be converted for 135, 500 or 600 ohm balanced line measurements with Sierra 122 Line-Bridging Transformer. (Low cost, plug-in unit). **Same as 101A except uses Model 155 Transformer. †Contains carrier re-insertion oscillator for monitoring single side band suppressed carrier systems. Data subject to change without notice.

Sierra

Sierra Electronic Corporation
San Carlos 2, California, U. S. A.
Sales representatives in major cities
Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wideband RF Transformers, Custom Radio Transmitters, VHF-UHF Detectors, Variable Impedance Wattmeters, Reflection Coefficient Meters.
2068

INDUSTRIAL BRIEFS

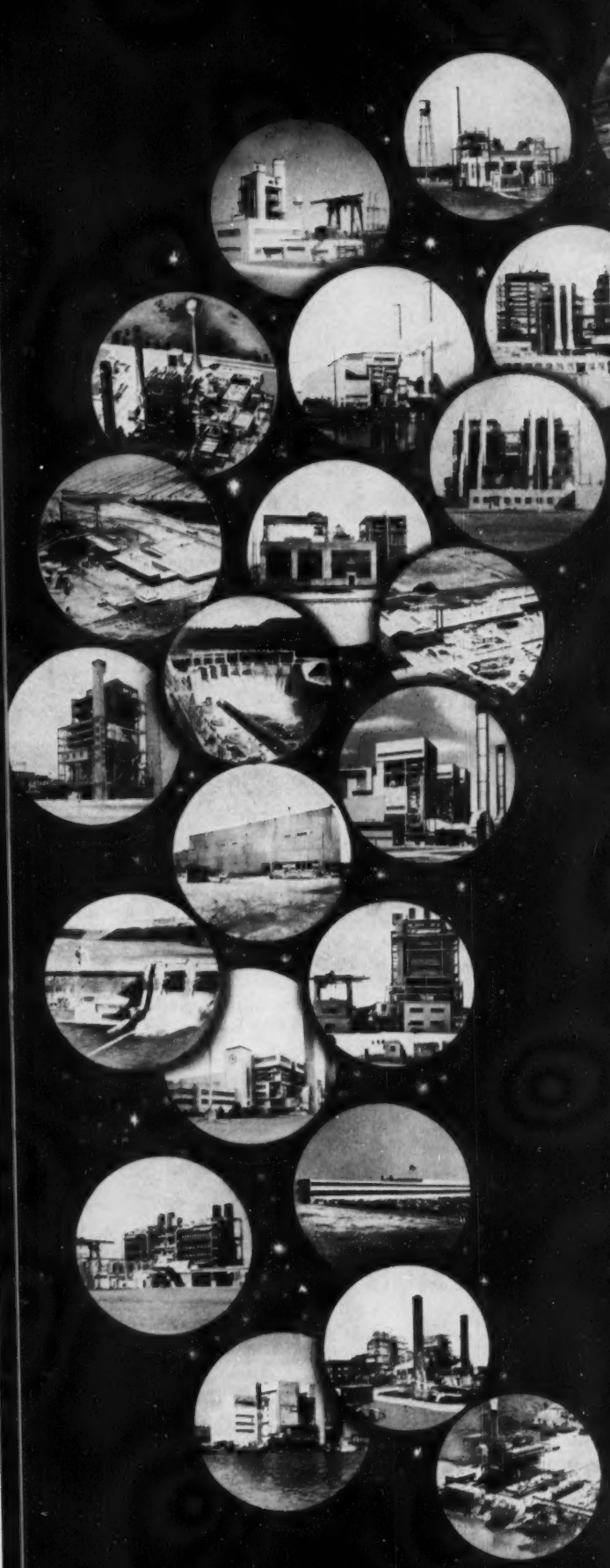
Melting type metal with 2-kw electric melting pot, replacing gas units at Wickersham Printing Co, Lancaster, Pa., has reduced room temperatures and added to employee comfort. Unit also eliminates unsightly venting ducts required with gas. Splendid results obtained may lead to complete electrification of company's melting operations. Don Groome, Industrial Power Rep., Pennsylvania Power & Light Co.

Bonding brake bands to brake shoes with a 24-kw electric oven at Stevenson Manufacturing Co, Minneapolis, Minn. reduces costs and assembly-line, conveyor-belt operation. Bonding requires 15 min heating time so conveyor belt speed is set to allow this time in oven. With old type oven it was necessary to handle each piece individually. Old brake shoes are reclaimed and polished with buffers. Plastic adhesives are applied, and bank is clamped to shoe and placed on conveyor belt which passes through oven. Temperature is maintained at 325 F to 350 F. A. W. MacNabb, Northern States Power Co.

Air conditioning the canning department at Hygienic Products Co, Canton, Ohio, with two-10-ton units permits operation regardless of atmospheric conditions. Previously the department had to be shut down on humid days as the spillage of the product, which is both hygroscopic and corrosive, would cling to the cans, corroding them to the extent that their sales-appeal was lost. This problem has been eliminated and the air conditioning has also made it easier to keep machinery clean thus eliminating previous costly shut downs due to clogged equipment. R. L. Dible, Industrial Sales, Ohio Power Co.

SEND IN
***YOUR* INDUSTRIAL BRIEF**

You'll get more satisfaction from knowing your item helped someone else than from the $5 you will be paid for each item accepted. Give us the basic facts covering the application; the name and location of user; benefits, advantages, and load characteristics of the application. Mail to: Industrial Briefs Editor, Electrical World, 330 W. 42 St., New York 18.



More than Two Billion Dollars of Plant Construction

In its half-century of service to business and industry, Ebasco has been responsible for the engineering and construction of more than two billion dollars of new plants.

These plants have been built for many industries, in many countries. Each has been an individual project—individually handled, individually engineered—from site selection, initial planning, engineering, through finished construction. And each has been the product of Ebasco teamwork . . . teamwork that calls into action the services of Ebasco's highly-experienced specialists.

Your new plant will benefit from the application of this specialized experience. The caliber of the engineers and constructors behind your plant may well determine the extent of its future success.

Our booklet—"The Inside Story of Outside Help"—tells the story of Ebasco and its services. For a copy, without obligation, write Ebasco Services Incorporated, Two Rector Street, New York 6, N. Y.

ENGINEERS · CONSTRUCTORS
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BUSINESS CONSULTANTS

NEW YORK · CHICAGO · DALLAS
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Appraisal • Budget • Business Studies
Consulting Engineering • Design & Construction
Financial • Industrial Relations • Inspection & Expediting • Insurance, Pensions & Safety
Purchasing • Rates & Pricing • Research • Sales & Public Relations • Space Planning • Systems & Methods • Tax • Traffic • Washington Office.

BASEBALL FIELD LIGHTING at Huntington, Ind. sheds 23 ft-c on infield, 15 ft-c on outfield and 35 ft-c at home plate. Lamps are burned at 10% overvoltage for additional light. Citizens equipped and lighted the field to provide evening recreation for youngsters

Lighted Field Pulls Kids off Streets

DAYTON T. FORTNER, Sales Supervisor, Public Service Co of Indiana, Kokomo, Ind.

A little work and money plus some electric lighting has helped public spirited citizens of Huntington, Ind. to carry out a recreational project that is doing much to prevent juvenile delinquency.

The people of Huntington have converted a little-used carnival lot into a well-lighted, well-equipped athletic field where kids between the ages of 8 and 14 now can play night baseball. Field even has an electric scoreboard. Labor, funds for equipment and the field itself were donated by Huntington citizens.

For help on lighting, the Public Service Co of Indiana was consulted. Their recommendations provided for 96 kw of lighting on eight poles. The four infield poles have ten 1,500-w floodlights on each and the four outfield poles each have six 1,500-w floodlights, giving a total of 64 units. Lamps are burned at 10% overvoltage to get additional light. System produces illumination averaging 35 ft-c at home plate, 23 ft-c on the infield and 15 ft-c on the outfield.

KIDS EVEN HAVE an electric scoreboard for their Little League and Pony League games

RAPP with WOMA Gets Results for Arizona PS

RAPP with WOMA is rapping the door to new appliance sales and better dealer and employee relations.

Results of Arizona Public Service Co's now famous purchase plan (EW, June 28, p 110) for the first 12 months show these results:

- Sales of 1,131 major appliances to 943 employees. In the year before the plan only 229 employees bought new appliances.
- Dealers sales totaling $257,400.
- Additional annual revenue to Arizona PS estimated at $24,000.

The RAPP (Reddy Appliance Purchase Plan) with WOMA (word of mouth advertising) plan was instituted by the company to help get load-building appliances into employees' homes. It provides employees with a wide selection of appliances at special rates which they purchase through local dealers cooperating in the plan. This is the RAPP part. Each employee then gets five prospect cards from his dealer which he returns later with names of persons who have seen his new appliance demonstrated in his home—the WOMA part.

"Results so far," says Don Willis, Arizona PS vice president, "are highly gratifying. The dealers are gaining bigger sales and more prospects; employees are getting a wider selection of appliances at lower cost; and the company is getting more revenues and better employee, dealer relations."

Connecticut L&P to Trim Its Home Appliance Line

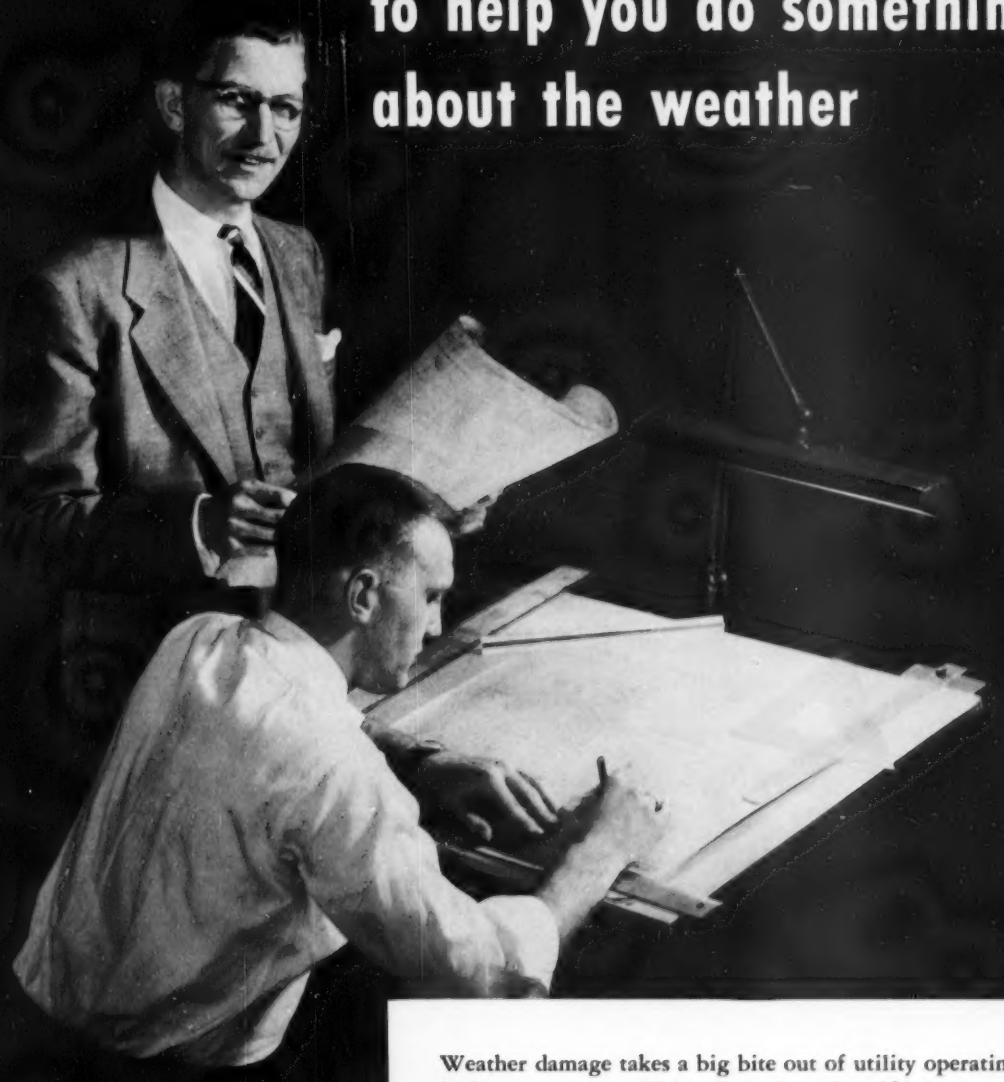
Connecticut Light & Power Co beginning Jan. 1 will limit its sales of appliances only to those which "contribute more directly toward the fullest use of the company's facilities."

Alfred M. Wade, vice president in charge of sales, said CL&P will confine its sales of household appliances to electric and gas ranges, water heaters, clothes dryers and space heating equipment. Electric blankets, lamp bulbs and fuses also will be carried.

To be discontinued are refrigerators, food freezers, washing machines and all small electric appliances—items which it says have almost complete

(*Continued on page* 137)

Equipment design to help you do something about the weather



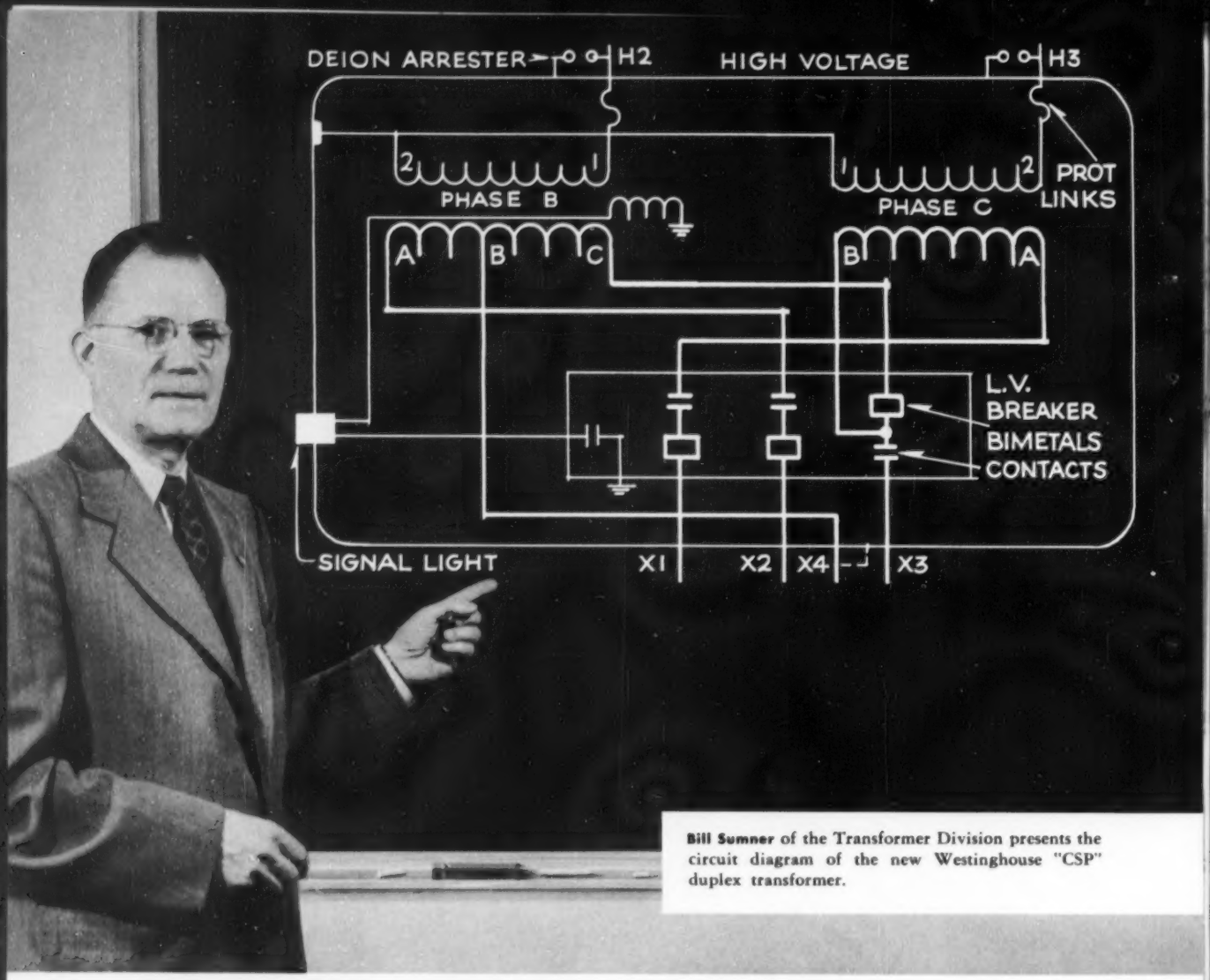
Weather damage takes a big bite out of utility operating budgets every year. This toll can be reduced by improved characteristics in many major items of equipment.

On the following seven pages, Pascal Beckjord, Manager, Customer Section, Westinghouse Electric Utility Sales, shows the progress being made along these lines.

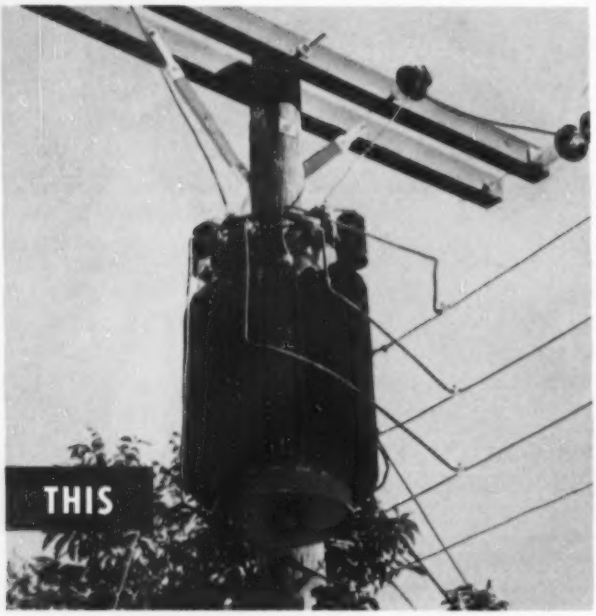
Bill Sumner, Division Manager, Distribution Transformer Engineering Department, starts out the discussion on the next two pages with an interesting new transformer development.

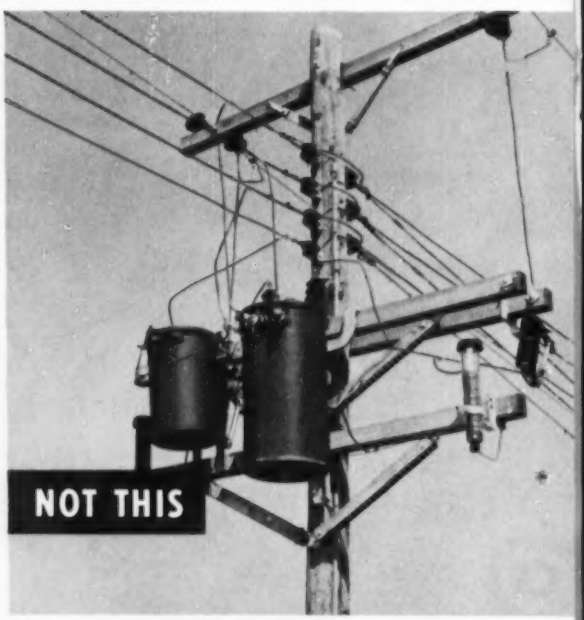
YOU CAN BE SURE...IF IT'S

Westinghouse



Bill Sumner of the Transformer Division presents the circuit diagram of the new Westinghouse "CSP" duplex transformer.





A single Westinghouse "CSP" duplex transformer (left) supplies both single- and three-phase loads. It's light enough to mount directly to the pole. It replaces the two transformers and extra crossarms shown at right.

New "CSP"® duplex transformer takes the heat off summer load peaks

As you know, summer load peaks caused by the increased use of air conditioning can create load problems in certain areas. The new Westinghouse "CSP" duplex transformer answers this problem by supplying *both* single- and three-phase loads from a single unit, with the extra benefits of "CSP" protection.

The "CSP" duplex has two different ratings of single-phase core-coil assemblies connected in either open wye or open delta on the high-voltage side and open delta on the low-voltage side. A midtap is taken from the larger assembly for the single-phase load, while three-phase power is taken at the same time from the open-delta connection.

You get lower installation costs because no extra crossarms are necessary. The "CSP" duplex can be mounted directly to the pole. Obviously, it's easier and faster to install one unit instead of two.

Complete protection against internal and external faults is another feature of the "CSP" duplex transformer with built-in lightning arrester, circuit breaker and protective links—all coordinated at the factory with transformer insulation level.

Add to these such practical benefits as neater pole tops, less space required for warehousing, and the new "CSP" duplex transformer makes an attractive package—one which can aid greatly in solving a transformer problem created by the weather.

On the next two pages, Al Opsahl, Lightning Arrester Engineer, points out a lightning arrester advancement and Gil Easley, Power Circuit Breaker Engineer, talks about the weather and power circuit breakers. →

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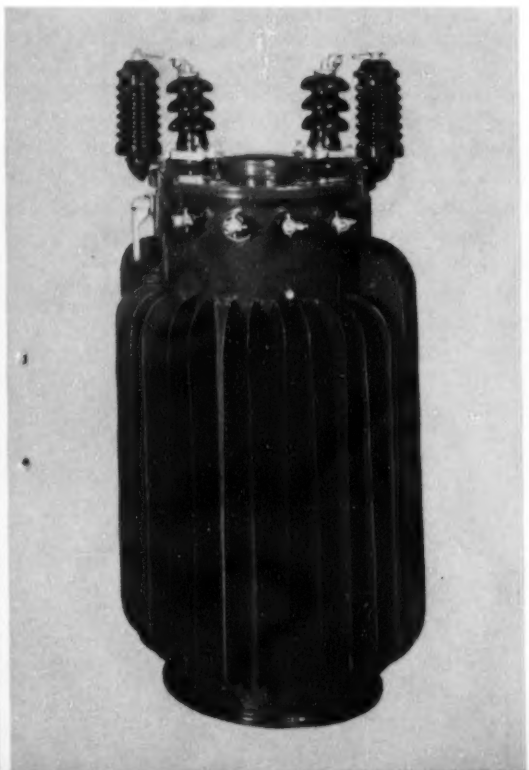
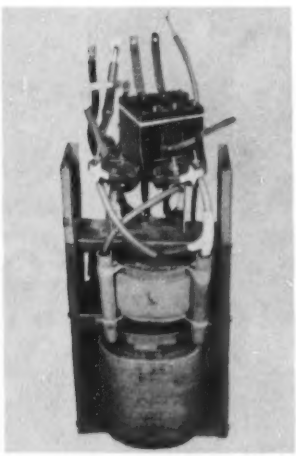
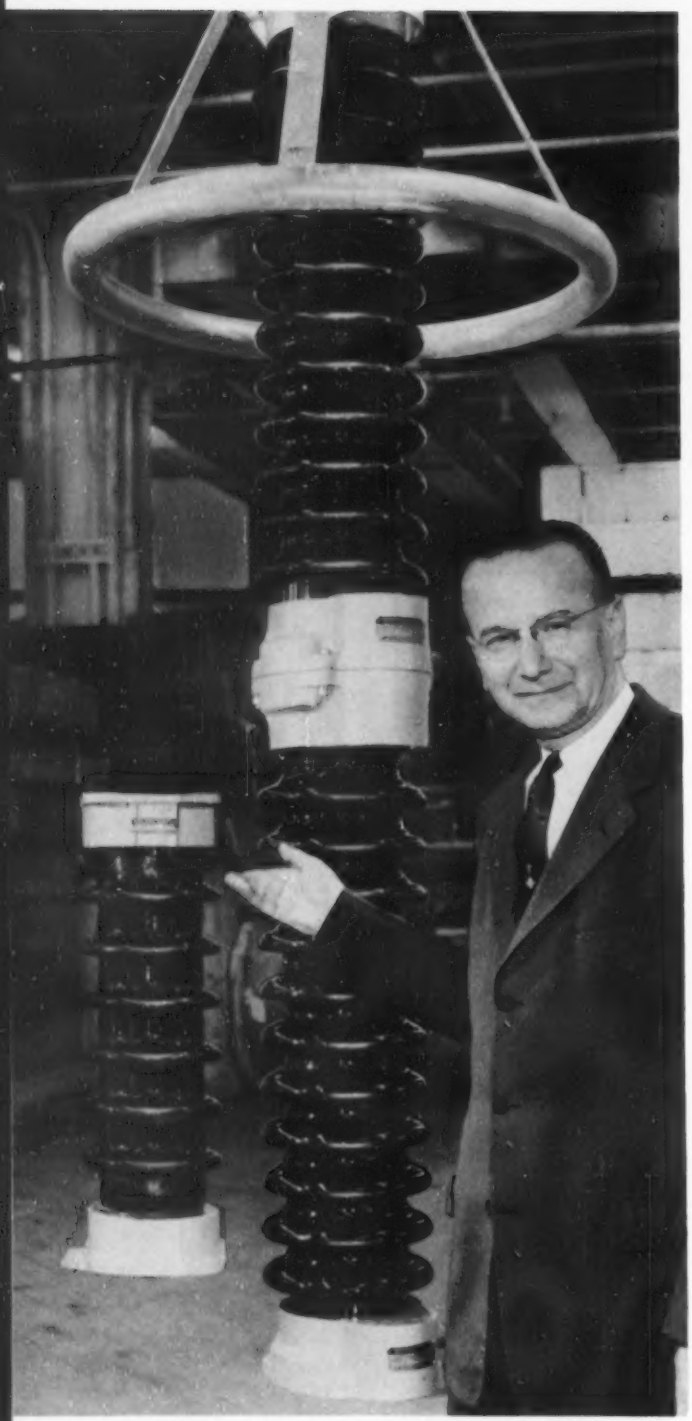




Extra transformer capacity is actually possible with the "CSP" duplex transformer. With open delta, the large and small core-coil assemblies are arranged to take advantage of the difference in the power factor of the single- and three-phase loads, thus the winding current is actually reduced. Extra transformer capacity is thereby available without exceeding temperature rise. Note in the illustration at the left that the "CSP" duplex transformer has two high-voltage bushings—one for each phase—with a ground terminal on the tank for the neutral connections.

New characteristics assure superior arrester performance



Al Opsahl, Lightning Arrester Engineer, tells why SV and LVS arresters give you the best protection available.

Here's new weather-beating performance in an arrester design that has been *proved* completely sound in over 14 years of field experience.

Maximum discharge voltages of Westinghouse SV (station) and LVS (line) arresters have been lowered to give you the greatest protective margins available in high-capacity arresters (see table below). This was achieved through improved Autovalve® block manufacturing and testing techniques. Impulse sparkover values for the LVS have been reduced without reducing the 60-cycle sparkover. New pressure relief diaphragm relieves severe gas pressures in event of internal short circuit.

To give you all these performance pluses, no basic design changes were necessary. Retained are all these time-proved features: exclusive moisture-proof solder seal; aluminum alloy end castings; separately sealed gap assemblies; surge capacities well above industry standards.

Don't take a chance on weather—or unproved arrester designs. Get Westinghouse SV and LVS arresters—now more than ever, the best lightning protection your system ever had.

Maximum discharge voltages, kv crest, for the following discharge currents in amperes crest, 10 x 20 microseconds

SV ARRESTERS

Arrester Rating Kv Rms	1500	5000	10000	20000	100000
12	29	34	37	40	50
30	73	85	93	100	125
73	178	206	225	245	305
195	475	550	595	645	810

LVS ARRESTERS

Arrester Rating Kv Rms	1500	5000	10000	20000
12	35	41	45	50
30	86	101	112	124
73	220	262	290	320

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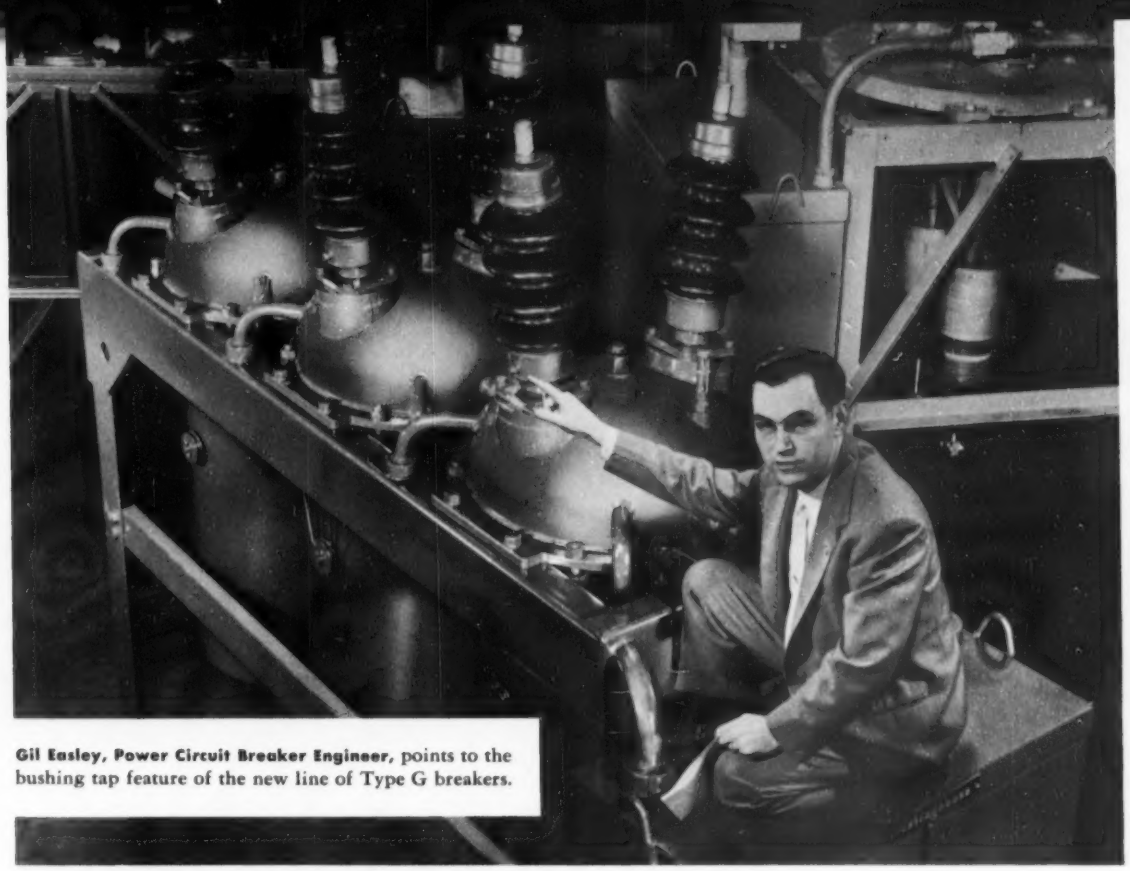


Gil Easley, Power Circuit Breaker Engineer, points to the bushing tap feature of the new line of Type G breakers.

New Type G breakers streamlined to combat weather factors, simplify maintenance

The big news in frame-mounted circuit breakers is the redesign of the complete line of Westinghouse Type G breakers, 14.4 through 69 kv, to give you the most weather-resistant—most easily maintained breakers available.

The breakers are streamlined—clean and uncluttered in appearance. Domed tops make possible the elimination of external lever boxes and transformer secondary conduit and condulets—affording much greater protection against moisture and greatly simplifying maintenance. Frames are simpler, yet sturdier, with bushing current transformer secondary leads enclosed in the top frame member. Tanks have a new shape—a wider base for greater stability when lowered, either full of oil or empty.

The new design retains the solder-seal condenser bushing but provision is also made for ungrounded power factor testing—a convenient method that involves only disconnecting a bushing tap. A Kovar® seal on the tap backs up the solder seal that absolutely excludes moisture from the bushing.

"De-ion®" grid interrupters—used in previous designs and proved by years of field experience—have been retained in the new design. Even so, interrupting ratings of the new breakers have been reverified by tests in the High Power Laboratory. The breakers will be equipped with mechanically trip-free AA-7 and AA-10 pneumatic mechanisms or with solenoid mechanisms.

On the next two pages, Gino Marleni, Relay Design Engineer, discusses relay protection for transformers and Jack Hoffecker, Large Power Transformer Sales Manager, presents a transformer design that helps win the lightning battle.

Westinghouse

CA-5 relay decreases transformer outages

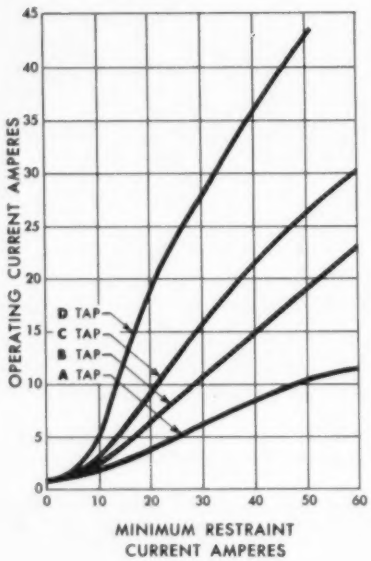
Lightning strokes on transmission or distribution lines can result in heavy faults with accompanying high-current flow. When the fault is external to transformers on the line, it is preferable to trip off the faulted lines and allow the transformer bank to stay in service. The result is better customer service—less loss of revenue.

Heavy external faults may cause the current transformers to depart from their true ratio and thus feed unbalanced currents to the differential relays, falsely indicating a possible internal fault.

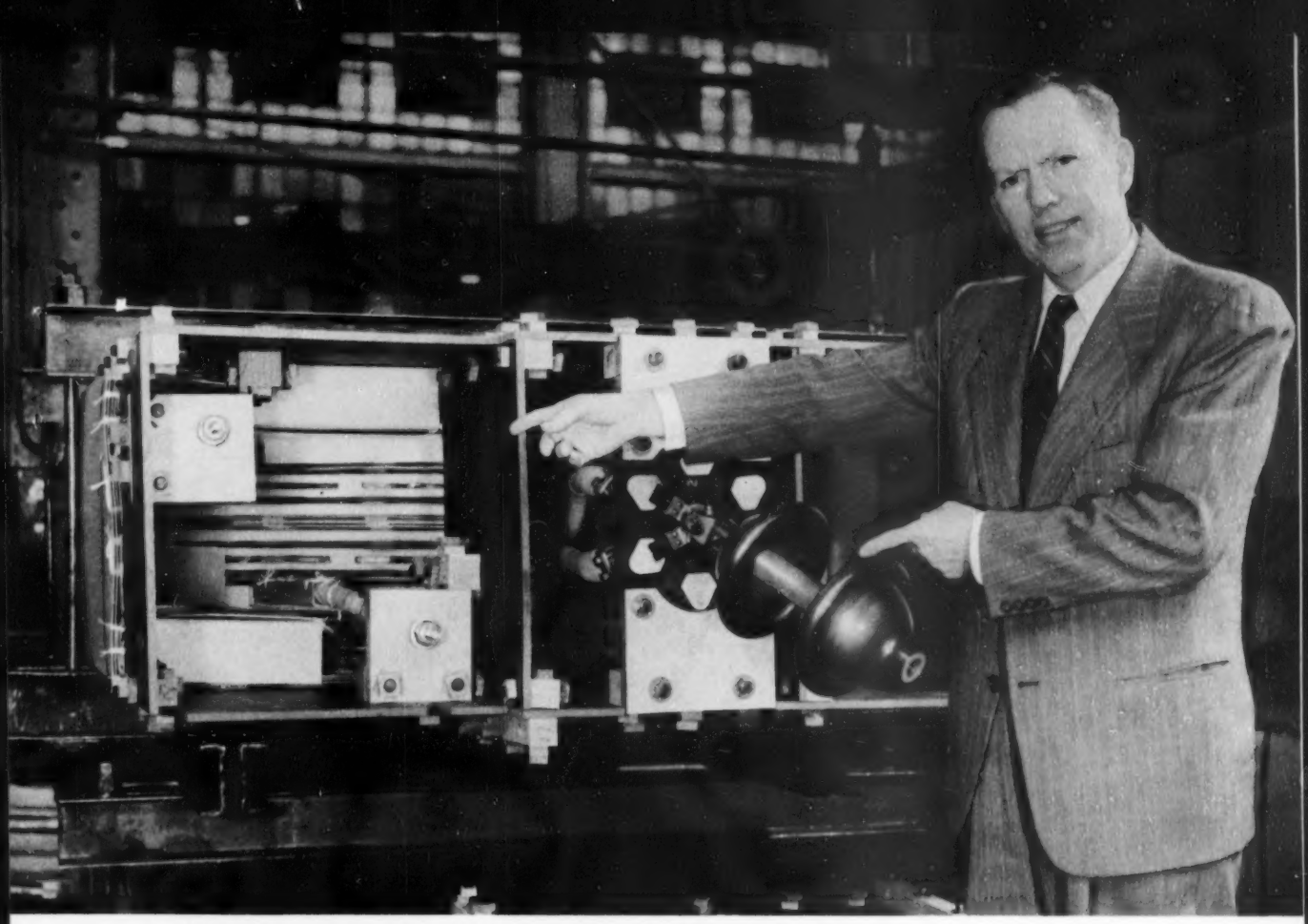
The operating characteristic shown in the chart at the right indicates how the Westinghouse CA-5 *variable* percentage differential relay eliminates the possibility of false trip-out. The CA-5 variable-tap adjusting transformer permits *control* of the sensitivity of the relay operating element.

The relay is highly sensitive to light, internal faults within the transformer bank. At the same time, the reduced sensitivity at higher currents allows the current transformers to depart from their true ratio without causing false tripping due to external faults.

In your battle against weather, the CA-5 relay is worth consideration both from a protection standpoint and outages of key equipment.



Gino Marleni, Relay Design Engineer, points out CA-5 relays used for transformer protection.



Jack Hoffecker, Manager, Large Power Transformer Sales, points out proper application of insulation in Form-Fit coil group.

"Creepage" paths eliminated in Form-Fit design

When a power transformer is subjected to a voltage surge, any potential creepage paths along insulation surfaces may result in failure. In recognition of this problem, Westinghouse engineers for many years have designed insulation structures to prevent internal corona, thereby eliminating the possibility of transformer damage from this cause.

As you know, insulation is much stronger in puncture than it is in "creep". By interleaving solid insulation so that it follows the equipotential planes around the high-voltage coils, between them and the low-voltage coils and the core; and on the corners where stress is high, creepage paths are eliminated. In addition, by rounding the corners, stresses are spread over larger areas, reducing unit stress gradients. Jack Hoffecker points out, in the Form-Fit coil group shown above, how proper application of box-type insulation has made use of these principles. Note also how the tap changer is insulated to eliminate creepage along the shaft by confining the stress to the oil between the rounded surfaces of the bells. Even the tap changer contacts are insulated from the board to avoid creepage. Again, stresses are confined to the oil.

Such strict attention to detail is your assurance that Westinghouse Form-Fit power transformers are engineered throughout to meet the worst of surge conditions with adequate margins of safety.

On the next page, John Chiles, Engineering Manager of the Transformer Division, discusses economic factors in insulation design.

→

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Proved: Reduced insulation levels meet both weather and cost requirements

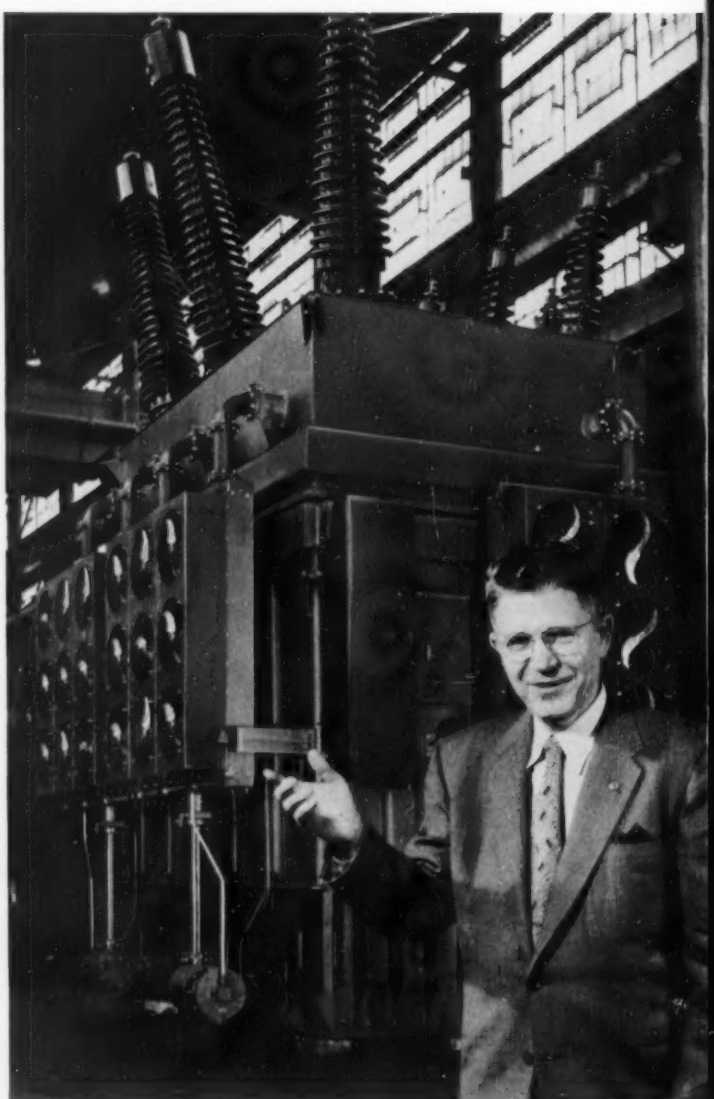
With utilities cooperating, much progress has been made in applying power transformers of reduced insulation levels to high-voltage systems that are solidly grounded and protected against lightning. Based on this cooperation, Westinghouse has been able to pioneer successively lower levels of insulation.

The application of reduced basic insulation levels is particularly adaptable to Westinghouse Form-Fit power transformer design. Its inherently high coil-to-coil and low coil-to-ground capacitance minimizes voltage oscillations. This permits the resulting stresses to be calculated with ease so that the required amount of insulation can be readily determined . . . without resort to models or prototypes. What does this mean to you?

Simply this: While maintaining margins which provide vital reliability—the key to continuity of service—you get a lighter, smaller transformer, a transformer with lower impedance and losses, minimized handling and installation problems . . . all of which add up to a better transformer at less cost!

Get detailed product facts . . .

from your Westinghouse representative. Or—if you prefer, you may write direct to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.



John Chiles, Engineering Manager of the Transformer Division, at a Form-Fit power transformer.

YOU CAN BE SURE...IF IT'S

Westinghouse

CP-1021

Trims Appliance Line

(*Continued from page* 128)

public acceptance. Present service policies will continue to apply to all such equipment purchased from the CP&L before the Jan. 1 changeover.

The modified program, said Mr. Wade, will enable CL&P to give greater promotional attention to these fewer appliances which it says "will contribute toward the greater use of our service." At the same time it will allow expansion of promotional activities with other dealers who sell and service appliances.

Lights Tame Danger Curve

Highway lighting has removed the death label for a once-dangerous curve on U.S. 1 near Fredericksburg, Va. The state's Highway Department records only three accidents in 17 months since installation of 20 sodium vapor lamps at the curve in January, 1953. Curve was the scene of 24 mishaps including three deaths in the two years prior to the new installation. Subsequent reduction in property damage losses alone is estimated at more than $20,000.

Oil Dealer Challenges Gas Co Motives

A flat guarantee that cost of heating over a 10-year period will be lower with oil fuel than with either natural gas or electricity is being offered by the Griffin Fuel Co, Tacoma, Wash. fuel oil dealer.

Edward L. Griffin, company president, attacked claims of gas companies that the advent of natural gas in the area will not disturb existing utilities. He charged that the gas pipeline company "hopes to sneak into the Northwest on a promotional scheme, not announcing its rates or

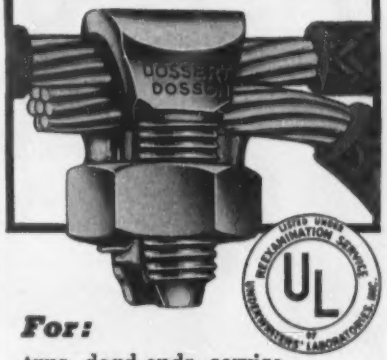
Alabama Power Opens Training Center

Vice Presidents E. W. Robinson (second from right) and E. C. Easter (left) of Alabama Power Co inspect residential lighting applications that are features of new Home Service Training Center recently opened at utility's main office building in Birmingham. Others in picture are Edith Hitchcock, C. T. Brasfield and J. P. Brown. Center will provide facilities for training home service employees and for public demonstrations. It includes reception room, equipment laboratory and offices plus rooms equipped for laundry and lighting training and lighting demonstrations.

NEW!

DOSSON "F"

SPLIT BOLT CONNECTOR



For:

taps, dead-ends, service entrances, motor leads, junction boxes, ground wire-to-neutral connections

Fabricated from high strength alloys, all component parts of the new Dosson "F" Connector are cold formed, insuring consistent uniformity and high quality. Can be used economically over and over again!

Why It's Your Best Bet:

- high clamping pressure insures tight contact
- maximum tightening force: high translation of tightening torque
- connector alloys possess greater physical properties than average steels
- longer bearing pressure bars avoid conductor crushing, load concentration
- smooth edges can't cut lineman's gloves, nick conductors
- withstands high overload, vibration, corrosion

50 YEARS OF TECHNICAL KNOW-HOW

FREE SAMPLE upon request. Write today!

IN STOCK FOR IMMEDIATE DELIVERY

DOSSERT REPRESENTATIVES IN PRINCIPAL CITIES

DOSSERT MFG. CORP.

249 HURON STREET, BROOKLYN 22, N. Y.

SINCE 1904

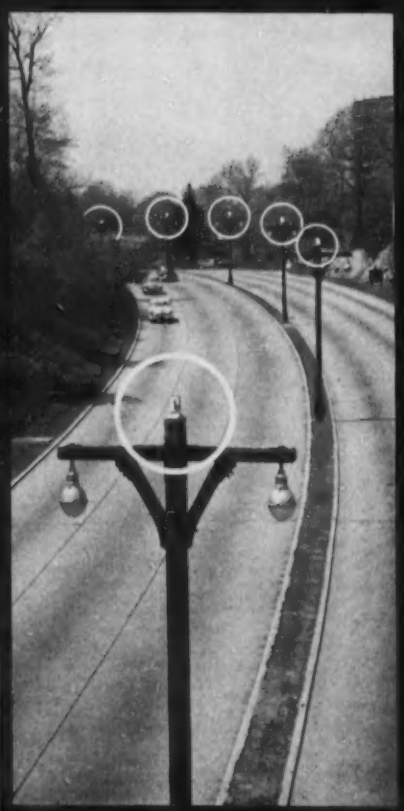
first IN SIMPLICITY EFFICIENCY LOW COST

LUMATROL®

Omni-Directional Photoelectric Light Switch integrates light from all directions . . . completely reliable in any weather, 12 months of the year!

LUMATROL offers *fully* automatic light control that is simple, reliable, compact and easy to install. LUMATROL can be used with, or easily adapted to, virtually *any outdoor lighting requirement*, regardless of location, type of pole or luminaire!

Although considerably lower in cost, LUMATROL rates FIRST on all twelve specifications applied to this type control. Only ruggedized components are used. ACCURATE, POSITIVE SWITCHING OF ILLUMINATION IS ASSURED UNDER ALL CONDITIONS OF USE. Where ever specified, Lumatrol is producing marked economies in maintenance and service costs.



TYPICAL LUMATROL INSTALLATION ON WOOD POLES OVER HENRY HUDSON PARKWAY, NEW YORK CITY,

WRITE TODAY FOR TECHNICAL BULLETIN.

micro balancing

INCORPORATED

GARDEN CITY PARK, L. I., NEW YORK

*Trade Mark Reg. U.S. Pat. Off.

what the cost will be, and gain control of the market that our (electric) utilities need the most and want—the cooking and hot water load."

Griffin sees no quarrel between fuel oil dealers and the electric utilities. The utilities do not want the space heating load, he believes, and "are working feverishly to quiet down any talk of heating by electricity."

S & S Shorts

Philadelphia Wins Housewares Prize

The Electrical Association of Philadelphia has been named winner for the second time of NEMA's Electric Housewares Section Award for electrical leagues. Presentation was made to John Morrison, association manager, by H. S. Perkins, the NEMA section's Sales Promotion Committee chairman, at recent International Association of Electric Leagues conference in Philadelphia. Award is given yearly to the electric league doing the best job of promoting electric housewares.

Light Conditioning Discussed

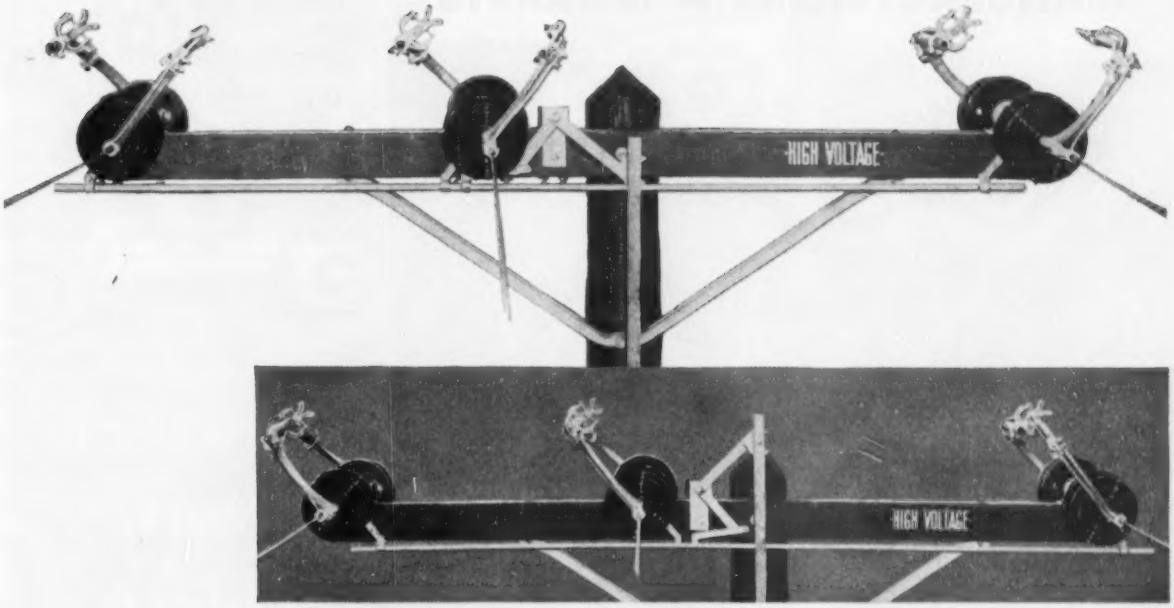
Ways to merchandise light conditioning at the point of sale was chief topic at first annual Home Lighting Fixture Distributors' Conference held recently at General Electric Co's Nela Park in Cleveland. Some 43 representatives from 30 firms attended.

AW Up in Chicago

There was a 105% increase in the number of Adequate Wiring Certificates issued to new housing units in the Chicago area during first seven months of '54 compared to same period last year reports Electric Association of Chicago.

New Loads from Fry Kettles

New England Electric System added load of 2,033 kw and $60,000 in estimated annual revenue as a result of its quota-breaking third annual fry kettle campaign. Sold were 239 fryers and 123 grills and griddles. In campaign's three years 598 units have been installed to add 3722 kw to system's commercial cooking load. Promotion includes personal letters enlisting dealer cooperation, heavy direct mail and salesman contacts.



Note clean, neat pole top appearance of KPF switches open (top picture) and closed. Appearance is marked contrast with usual clutter of mechanism.

Simple design and sturdy construction insure years of trouble-free switching

KPF Air Break Switches look different because they *are* different. They are the simplest air break switches made. They consist of two rigid dead-end insulator assemblies with rigid jumpers forming the switch arms. One assembly is mounted stationary to the cross-arm. The other rotates to make and break the circuit. There are no complex parts to get out of order, require lubrication, adjustment or other service. Sturdy KPF switches serve indefinitely.

Simple design also means simpler manufacturing and lower cost. No separate dead-ends or extra insulators are required.

Finally, installation normally requires less than half the normal time. Phase units are shipped ready for use and need only be bolted to the cross-arm.

KPF Air Break Switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies.

For the world's simplest, surest, lowest cost air break switch, specify KPF Air Break Switches—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

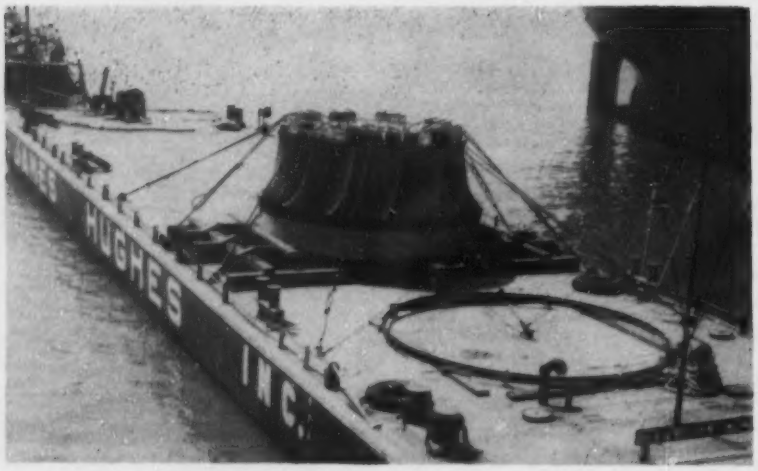
KPF ELECTRIC COMPANY

1624 East Alpine Avenue, Dept. E, Stockton 5, California

KPF

AIR BREAK SWITCHES

Standard for nearly half a century



"Gulliver" of Turbine Runners Tied Down

First of three giant hydraulic turbine runners for the Garrison Dam hydroelectric plant is shown prepared for shipment to the Corps of Engineers, U. S. Army, flood control and electric generating station. Built by Baldwin-Lima-Hamilton Corp, Philadelphia, Pa, each of the three Francis type runners will be reportedly the largest cast in one piece. Diameter is slightly over 18.5 ft; height is 9 ft; and weight is 173,000 lb. Maximum rating is 134,000 hp, limited by a generator loading of 115%.

Being too large to ship by railroad in the east, this first runner was loaded on a barge (large enough to assure seaworthiness) near the B-L-H plant. It was transported up the Hudson River to the Erie Canal and across the Great Lakes to Superior, Wis. From there a special railroad car built by Baldwin carried the runner to its destination—the dam on the Missouri River near Riverdale, N. D.

The second runner, due for shipment in December or January, will be shipped south along the coast, then into the Gulf of Mexico and up the Mississippi River because of ice on the Great Lakes. The third runner is scheduled for shipment next spring when the route will be selected.

Canadian Aluminum Ups Production at Kitimat

The first phase of the Kitimat smelter is now in full production, according to the Aluminum Co of Canada Ltd. The second series of electric furnaces at this aluminum center started production in late September, giving two pot lines producing aluminum.

First pour of metal from the first line of furnaces took place at Kitimat on August 3. That climax to 3.5 years of construction is now followed by the starting of this second line and brings aluminum production to 91,500 tons with the presently installed 315,000 kw.

Kitimat's first shipment, 1,000 tons of aluminum, went by freighter the first week in October to Boston, Providence, and New York. Another 600 tons, the second shipment, was loaded onto railroad cars to be hauled to Canadian and United States points.

To hike aluminum ingot production in British Columbia by 65% the Aluminum Co of Canada has announced a $45 million expansion at Kitimat and Kemano. Installation of fourth 105,000-kw generator at Kemano and expansion of Kitimat pot lines is scheduled for completion by late 1956. Canadian General Electric Co will build the generator; Dominion Engineering will install the turbine.

Plastics Market 4 Billion Lb in 1957

"In the past decade the total volume of plastic materials produced has multiplied five fold. The 1953 total is estimated to be 3 billion lb worth approximately $1.5 billion. The 1953 rate of production was more than double that of 1949, and we estimate that annual consumption will exceed 4 billion lb by 1957." This plastic market situation was expressed by John Walsh, Arthur D. Little, Inc, Cambridge, Mass, in addressing the tenth annual meeting of the New England Section of the Society of the Plastics Industry recently at Bretton Woods, N. H.

Speaking on "Past, Present, and Potential Market for Plastics," Walsh continued, "In cubic footage produced, plastics are exceeded by lumber, cement, steel, and rubber. Plastics in turn exceed aluminum, copper, zinc, lead, and magnesium. Today about 60% of all plastics production goes into industrial and military products and the remaining 40% goes into consumer products. Thus the plastics industry is to a very large extent dependent upon the general economy.

An estimated consumption of the major plastic materials are shown in the accompanying table.

Estimated Consumption of Major Resins in 1947 and 1953 and Projected Consumption for 1957

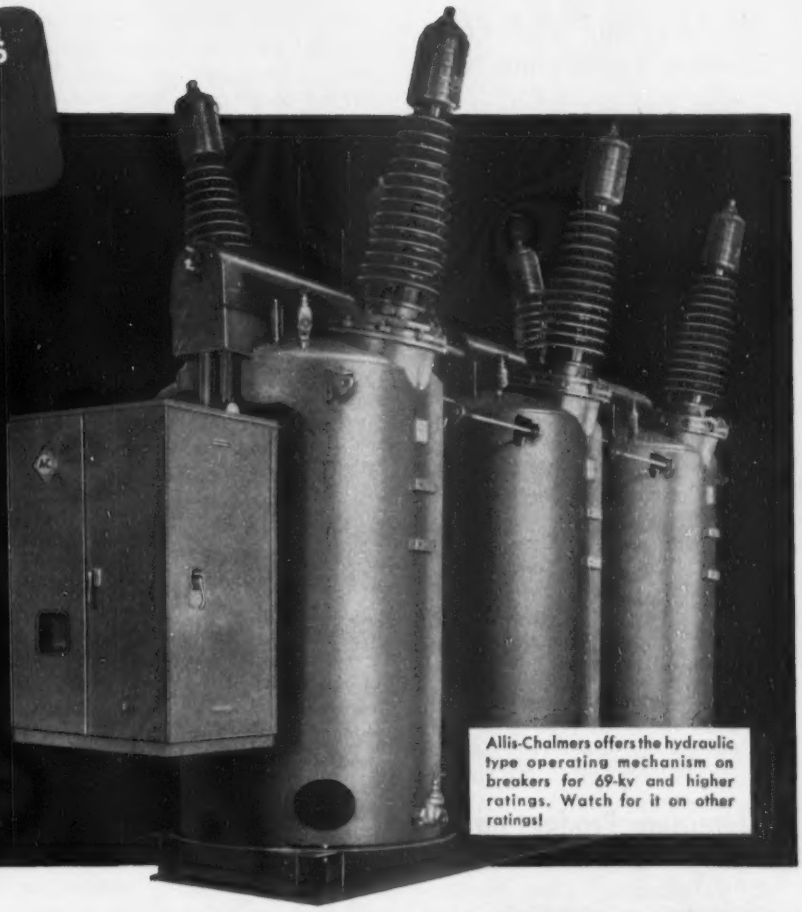
Resins	1947 Amount†	1953 Amount†	1953 %Growth Over 1947	1957* Amount†	1957* %Growth Over 1953
Acrylics	30	80	165	120	50
Alkyds (Molding)**	—	5	—	15	200
Cellulose Esters	100	113	13	125	11
Ethyl Cellulose	—	5	—	7	40
Epoxy Resins	—	10	—	45	350
Fluorocarbons	—	4	—	10	150
Melamines	17	55	220	130	135
Petroleum Resins	—	173	—	200	14
Phenolics	294	403	37	650	61
Polyesters	4	27	575	60	120
Polyethylene	15	120	700	500	320
Polystyrene	99	451	350	700	55
Silicones	—	5	—	15	200
Ureas	88	180	89	280	70
Vinyls	161	480	153	700	70

*Estimated.
**Alkyd resins, when used as a constituent of paints, are not included as a plastic. Consumption of these resins in paints approximates 360 million lb per year.
†Amount in millions of pounds.

ALLIS-CHALMERS

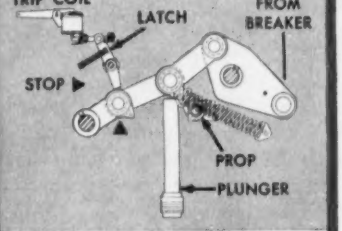
Progress in Switchgear

Get the 3 features that assure power continuity



Allis-Chalmers offers the hydraulic type operating mechanism on breakers for 69-kv and higher ratings. Watch for it on other ratings!

1



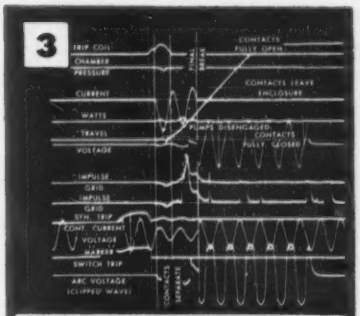
Mechanically trip-free operation gives high speed opening under all operating conditions. Simple uncoupling linkage permits contacts to open independently of closing piston position. Be sure your next breaker has fully mechanically trip-free operation.

2

Turbo Jet interrupter provides fast arc interruption with low arc energy release on both high current and difficult low current switching loads with leading or lagging power factors. Device utilizes bayonet type contact and high speed sickle contact.

Turbo Jet is an Allis-Chalmers trademark.

3



Completely tested — These breakers have been electrically tested to 10,000,000 kva. In addition, each Allis-Chalmers breaker is completely assembled and mechanically tested before shipment to assure easy assembly and proper operation in the field.

A4419

GET MORE INFORMATION! Call your nearby A-C district office, or write Allis-Chalmers. Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

New Zealand Calls For 30-Mva Transformer Bank

State Hydro-Electric Dept, New Zealand, is calling tenders for supply and delivery at Auckland of one 30,000 kva, 110/22-kv transformer bank and spare unit for the Otahuhu substation. The tender calls for four single-phase, double-wound transformer units, each 10,000 kva, 110/12.7 kv, 50 cps, outdoor type, oil immersed, with natural cooling and tap changing-on-load.

The transfomers will form an outdoor 30,000 kva, 3-phase bank with one spare unit, and will operate in parallel with the 30,000 kva bank supplied for Otahuhu under Section Nine, Auckland. It will be used to step down from 110 kv between phases to 22 kv between phases.

Transformers will be tested with British specifications for an area subject to lightning. Tenders close January 25, 1955. Copies of plans and specifications are available at New Zealand offices in Washington.

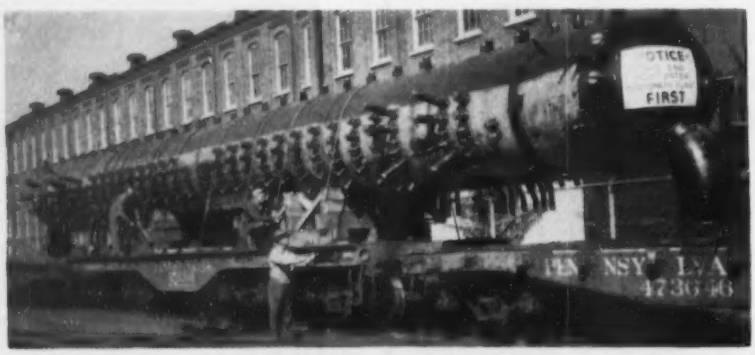
Aluminum Production

Primary aluminum production in U. S., according to the Aluminum Association, was 120,332 tons in September, an increase of 10% from 109,333 tons in September 1953, but a decrease of about 4% from 125,296 tons last August. Total production was 1,087,189 tons for the year through September as compared to 927,867 tons for the same period in 1953. Two all-time production records are: Monthly, July 1954, with 126,162 tons; and quarterly, third 1954, with 371,790 tons.

Ryerson Uses Stainless Steel Wall Construction

Sandwich type of wall construction with stainless steel sheeting is used in two new plants for Joseph T. Ryerson & Son Inc. The sheeting application reportedly marks the first such extensive use of the metal in mill type and craneway building walls. The new Milwaukee, Wis., plant is 200 x 800 ft; the addition at Jersey City, N. J., is 200 x 600 ft. Both buildings are approximately 40 ft high.

The thin sandwich walls are built-up of corrugated carbon steel sheets, a 1-in. rigid insulating board, and Alleghany stainless-steel sheets for the exterior. Insulating qualities are said to be equal to or somewhat better than those of a standard brick wall. Use of metal skins instead of thick masonry is also said to give 2 to 3% more usable space. In addition to improved appearance, use of stainless steel is expected to result in longer life with little if any maintenance required.



Giant Steam Drum Shipped By B&W

A 193-ton steam drum built by Babcock & Wilcox Co required three railroad flat cars for its trip from Barberton, Ohio, to Detroit. It is 182 ft long and the steel walls are almost 6 in. thick. The drum will become part of a 1,720,000 lb per hr, 2,000 psi boiler reported to be the largest single steam generator built in the world. This boiler will supply steam for the first of two turbine-generators, each 273 Mw maximum, to be installed at Detroit Edison Co's River Rouge Plant.

Los Angeles Completes Industrial Survey

The first statistical survey of the electronics industry in metropolitan Los Angeles has been compiled by the L. A. Chamber of Commerce Electronics Committee. Covering over 700 electronic and allied industry firms, the report includes summary statements on employment, personnel, research laboratories, and testing facilities.

The survey lists new business, exports, engineering and scientific manpower resources, markets, and professional and technical associations. Also included are alphabetical listings of manufacturers, products, and service establishments.

Copies of the survey at $1 each may be obtained from the Electronics Committee, Domestic Trade Dept, Los Angeles Chamber of Commerce, 1151 S. Broadway, Los Angeles 15, Calif.

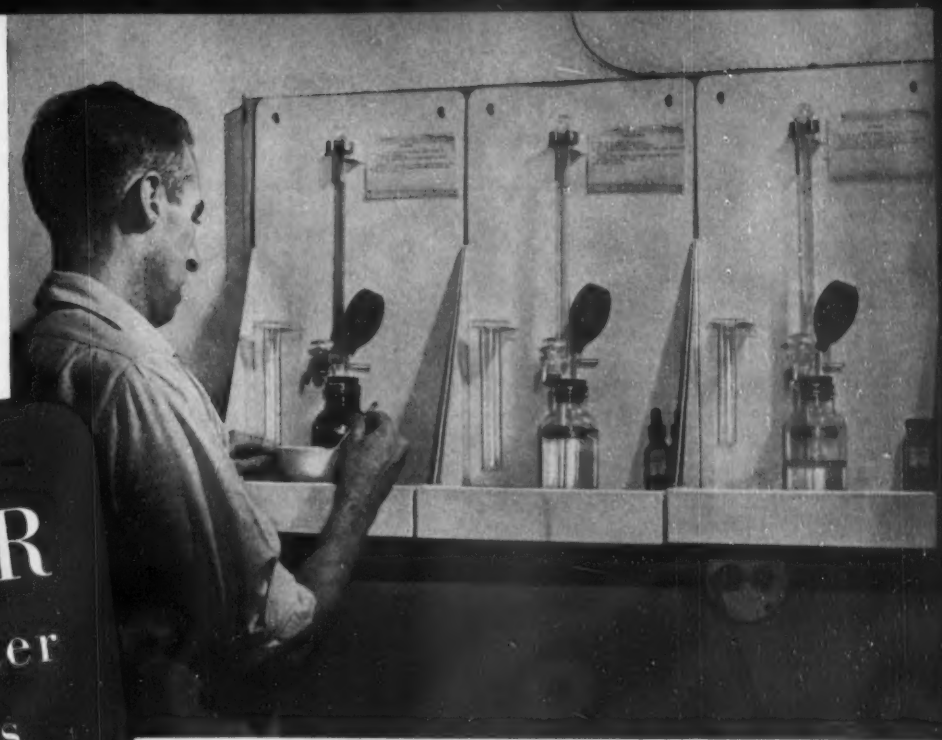
Place $4 Million Order For OVEC Insulation

Largest single order for furnishing and applying thermal insulation ever placed in the electric industry's history, amounting close to $4 million, was received as a contract by North Brothers of Atlanta, Ga. The insulating materials will be Fiberglas and Kaylo, both supplied by Owens-Corning Fiberglas Corp.

The insulation will be applied to the eleven steam generators, piping, and equipment in the Ohio Valley Electric Corp's two new steam-electric generating stations: 1,200-Mw Clifty Creek Plant at Madison, Ind., and 1,000-Mw Kyger Creek Plant at Cheshire, Ohio.

Honeywell Develops Servo Analyzer System

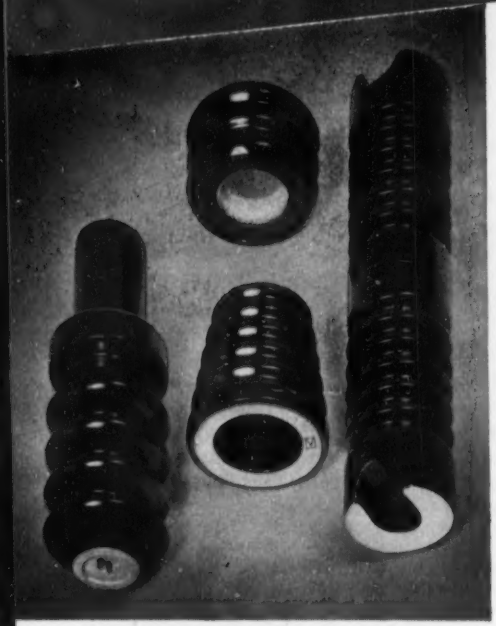
A servo analyzer system developed by Minneapolis-Honeywell's Industrial Division can analyze the characteristics of new processing equipment in a matter of minutes. Such advance analysis is said to save up to 60% of the research time involved in re-designing a process. Engineers can estimate the effect of new equipment



Continuous laboratory testing and special treatment of water make possible Victor *Purified* Porcelain

Another Reason Why—

VICTOR Makes Better Insulators



Victor manufactures many special shapes in addition to a complete line of standard porcelain for transmission and distribution.

ONLY VICTOR MAKES

PURIFIED PORCELAIN

Many milestones in insulator progress have been due to VICTOR research. But none is as important as its development of *Purified* Porcelain. By specially treating the water used in the manufacture of VICTOR Insulators and employing many other ceramic advances, VICTOR gives you the finest insulator porcelain ever made—porcelain which, for the first time in the industry, is *pure* porcelain all the way through!

Purified Porcelain has vastly greater uniformity in mechanical and electrical strength values, higher mechanical impact and puncture voltage values, greater density, hardness and permanence than any other insulator porcelain. That's why more and more power men are specifying VICTOR *Purified* Porcelain Insulators.

Specify VICTOR *PURIFIED PORCELAIN INSULATORS*

VICTOR INSULATORS, INC., VICTOR, N. Y.
SUBSIDIARY OF I-T-E CIRCUIT BREAKER CO.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators
Custom Designed Porcelain

WHEN YOU WANT SERVICE...

SPECIFY

BERMICO®

LIFETIME CONDUIT

For *real* service—prompt, efficient service—specify Bermico. Many Westinghouse Electric Supply Company offices carry, for immediate shipment, large, well-balanced stocks of all sizes, together with fittings for any situation you may encounter in installing underground ducts.

With Bermico Lifetime Conduit you get the greatest possible protection for your cable—at low cost. It means fewer outages, uninterrupted service for your customers, less expense for you.

Made from sturdy wood fibre, impregnated with pitch, Bermico is *completely uniform* from end to end. It is light, tight, strong, acid-resistant, with *uniformly smooth* bore. For best protection for your cable specify Bermico.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY, Berlin, New Hampshire
CORPORATION, La Tuque, Quebec

additions to an industrial operation without actually test-installing such equipment.

The electronic testing system automatically translates behavior characteristics of equipment to a chart record. This is analyzed to determine how the added component will affect the over-all behavior of the operation. The system is the result of some 10,000 man-hours research in the firm's servomechanism laboratory.

The system, which is portable, is made up of four components: A signal generator, portable potentiometer, control box, and function plotter. It provides three forms of test energy—pneumatic, mechanical, and electrical.

Asbestos and Fiberglas Combined in New Tapes

Raybestos-Manhattan Inc has combined Fiberglas yarns and asbestos spinning fiber to make new tapes for cable insulation applications.

Novabestos No. 7503 is used in the belt or fire wall of shipboard cables. No. 7504 is used as primary insulation over bare conductor in shipboard cables. It is also used as strap insulation in the winding of transformer coils. No. 7505 asphalt impregnated tape is used primarily in the manufacture of AVA and AVC types cables.

Three new Pyrotex tapes, No. 9519, 9520 and 9521, consist of two layers of asbestos felt with a glass cloth between and are available for essentially the same applications. The Fiberglas filling yarns will prevent (or at least materially reduce) lengthwise cracks in the taped insulation produced by the Navy's severe cold bend test.

Du Pont Opens Plant For Making Mylar

Du Pont's plant for manufacture of Mylar polyester film at Circleville, Ohio, is in commercial production. Anticipating lower costs as production goes up, the price is reduced by 15¢ a lb on all types and gauges of Mylar except the thinnest film, 25 gauge. This amounts to a 5% reduction on most types and gauges.

Since July the plant has been in

There IS a Difference!

Connectors may look alike but it's PERFORMANCE that counts

BLACKBURN CONNECTORS OUT-PERFORM THEM ALL

Because They Are . . .

BETTER MECHANICALLY

- Made of high strength duronze, a silicon bronze alloy stronger than structural steel.
- Machine cut threads, *CFC treated, provides more thread engagement —reduces friction and increases thread efficiency. *Chemical Friction Control.
- Rigid inspection of each production operation assures uniformly good connectors.

BETTER ELECTRICALLY

- High clamping force—the result of greater thread efficiency breaks down oxide on the conductor improving conductivity.
- Higher initial conductivity, actually greater than an equal length of conductor is maintained permanently.

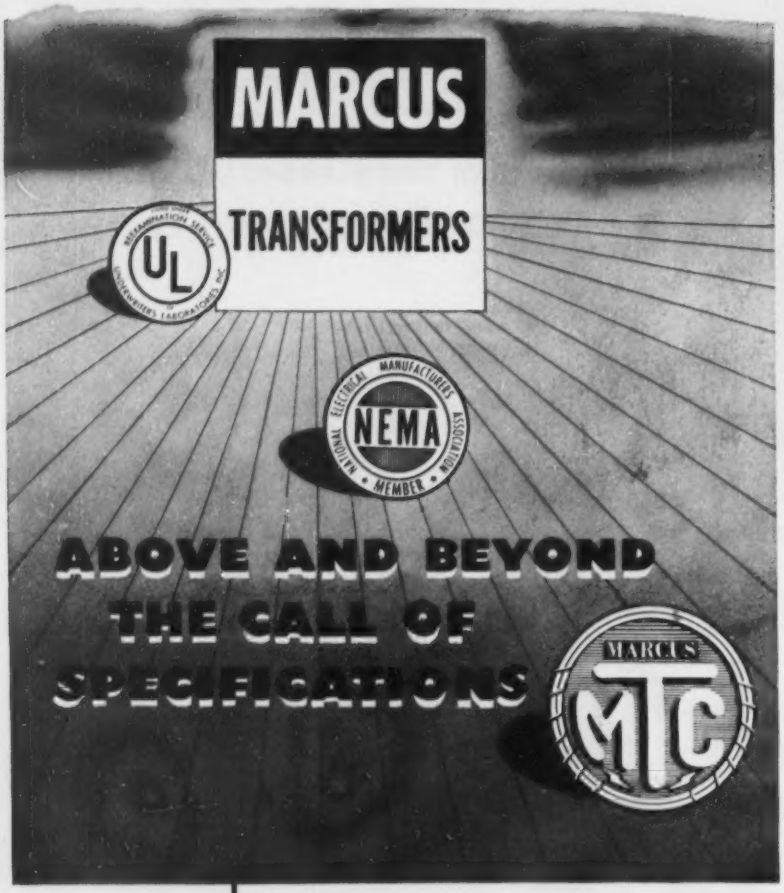
REUSABLE

- Selection of proper high-strength, corrosion-resistant materials—plus precision workmanship and inspection—means Blackburn connectors may be used over and over.

BLACKBURN *Hi-Strength* **CONNECTORS**

AVAILABLE AT ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORP., 35 Madison Street, St. Louis 6, Missouri • Phone MAin 1-2821



CHECK THESE MARCUS B "PLUS" FACTORS FIRST!

- Higher Dielectric Strength!
- Greater Capacity for Overloads!
- Greater Protection Against Surges!
- Quieter Operation!
- Better Protection Against Moisture!
- Proven Dependability!

Capacities from 1 to 3000 KVA

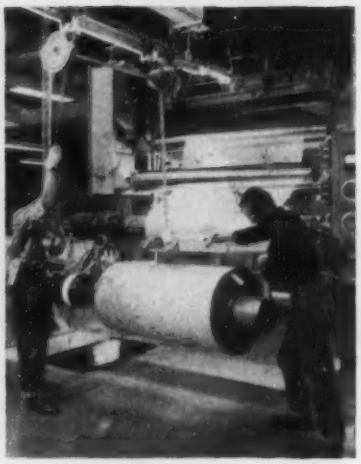
- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

Every MARCUS Transformer, whatever its class and for whatever purpose, is engineered and constructed to far exceed its particular specification demands. Underwriters Laboratories, Nema and AIEE standards are only a starting point for our development engineers. The proof of performance is evidenced in thousands of installations all over the world because MARCUS Series "5000" class B "Plus" Transformers approach class H insulation but operate at Class B temperatures. That safety factor plus constant research are your assurance that the MTC Seal on your Transformers means longer life, and uninterrupted trouble-free performance.

"Mark of Quality"

MARCUS
TRANSFORMER CO., INC.
RAHWAY, NEW JERSEY

Representatives in Principal Cities



start-up and tested for manufacture of various film types and gauges. Each step had to be proved out thoroughly—practically all the process equipment was specially designed and scaled-up from the pilot plant operated in Buffalo since 1950.

Status of Copper

Primary copper production in U. S., according to the Copper Institute, was 61,612 tons in September, a little increase over the 52,825 tons in August which was the lowest for the year to date.

Refined copper production was 87,623 tons in September. This tonnage is the lowest this year and is a reflection of low primary production in August. It continues down from 103,901 tons in August and 107,095 tons in July.

Copper deliveries were 88,947 tons in September, again the lowest this year, down from 92,475 tons in August and 97,436 tons in July.

Producers stocks of refined copper were 47,666 tons in September, another year's low; under 58,387 tons of stock in August and 68,921 tons in July.

Outside the U. S., primary copper production was 125,082 tons in September, a slight rise from 122,656 tons in August. Refined copper production was 107,489 tons in September, up from 100,437 tons in August. Deliveries to fabricators were 110,234 tons in September compared to 103,405 tons in August. Producers refined stocks were 172,048 tons in September, a slight decrease from 172,326 tons in August.

-with Chase® Copper Bus Conductors!

Chase Square Copper Tube Bus Conductors are *ventilated* so more heat is *dissipated.* Result: current-carrying capacity is increased *up to 20%*. They'll handle even heavy short-circuit currents—and are strong enough for use in longer unsupported lengths. Call your nearest Chase Warehouse or Sales Office.

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany†	Chicago	Denver†	Kansas City, Mo.	Newark	Pittsburgh	San Francisco
Atlanta	Cincinnati	Detroit	Los Angeles	New Orleans	Providence	Seattle
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales office only)

New

JEWEL BEARING SERVICE PAK

HERE'S MAXIMUM ASSURANCE OF TOP BEARING SURFACE CONDITIONS — when you use these NEW Jewel Bearing Service Paks.

TWO SIZES of clear-sight VIALS for diversified sizes of JEWEL BEARINGS

These clear-vision SERVICE PAKS with the inner VIALS allow immediate checking of quantity available. All possibility of blemishes on the polish, scratches, ruptures, or foreign matter present — is eliminated.

All Eastern Specialty Jewel Bearings are now packed in the complete SERVICE PAK. Maximum protection at minimum cost.

Write for Complete Information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

MEETINGS CALENDAR

AMERICAN WELDING SOCIETY
National Fall Meeting, Sherman Hotel, Chicago, Nov. 1-5.

LOUISIANA POLYTECHNIC INSTITUTE
3rd Annual Instrumentation Conference, School of Engineering, Ruston, La., Nov. 4-5.

NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION
Region VIII, Jung Hotel, New Orleans, La., Nov. 4-5; Region II, General Oglethorpe, Savannah, Ga., Nov. 8-9.

PENNSYLVANIA ELECTRIC ASSOCIATION
Fall Meeting, Transmission and Distribution Committee, Alexander Hotel, Hagerstown, Md., Nov. 4-5.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
Annual Meeting, Haddon Hall Hotel, Atlantic City, N. J., Nov. 8-11.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS
Annual Convention, La Salle Hotel, Chicago, Nov. 8-12.

SOUTHEASTERN ELECTRIC EXCHANGE
Accident Prevention Committee, Heidelberg Hotel, Baton Rouge, La., Nov. 11-12.

PUBLIC INFORMATION PROGRAM
Mid-Atlantic Region, Hotel Statler, Washington, D. C., Nov. 12.

EDISON ELECTRIC INSTITUTE
Industrial Power and Heating Section, Hotel Statler, Cleveland, Nov. 15-16; Industrial Relations Committee in conjunction with North Central Electric Association, Minneapolis, Minn., Nov. 18-19; Prime Movers Committee, Astor Hotel, New York, Nov. 29-30; Industrial Relations Committee, EEI Headquarters, New York, Dec. 16; Industrial Relations Committee, EEI Headquarters, New York, Jan. 20, 1955.

AMERICAN STANDARDS ASSOCIATION
36th Annual Meeting and 5th National Conference on Standards, Hotel Roosevelt, New York, Nov. 15-17.

WISCONSIN UTILITIES ASSOCIATION
Electric - Gas Sales and Engineering Convention, Schroeder Hotel, Milwaukee, Nov. 17-19.

NATIONAL FARM ELECTRIFICATION
1954 Meeting, Van Curler Hotel, Schenectady, N. Y., Nov. 18-19.

PACIFIC COAST ELECTRICAL ASSOCIATION
Joint Fall Conference of PCEA's Administrative Service Section and Accounting Section of Pacific Coast Gas Association, Sir Francis Drake Hotel, San Francisco, Nov. 18-19.

NEW JERSEY UTILITIES ASSOCIATION
Annual Meeting, Seaview Country Club, Absecon, N. J., Nov. 19.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual Meeting, Statler Hotel, New York, Nov. 28-Dec. 3.

PUBLIC UTILITIES ADVERTISING ASSOCIATION
Annual Meeting, Region 2, St. Moritz-on-the-Park, New York, Dec. 2-3.

21ST NATIONAL POWER SHOW
Sponsored by American Society of Mechanical Engineers, Commercial Museum, Philadelphia, Dec. 2-7.

INTERSTATE POWER CLUB
Meeting at Hotel Martinique, New York, Dec. 6.

EASTERN JOINT COMPUTER CONFERENCE-EXPOSITION
Sponsored jointly by American Institute of Electrical Engineers, Institute of Radio Engineers, and Association for Computing Machinery; Bellevue-Stratford Hotel, Philadelphia, Dec. 8-10.

ELECTRICAL EQUIPMENT REPRESENTATIVES ASSOCIATION
Annual Meeting, Breakers, Palm Beach, Fla., Jan. 10-12, 1955.

DOBLE ENGINEERING CONFERENCE
22nd Annual Meeting, Sheraton Plaza Hotel, Boston, Jan. 24-28, 1955.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co's General Machinery Division has made several district changes. Robert C. Bown, a representative in the firm's St. Louis district office since 1948, was appointed manager of the division's Evansville (Ind.) branch. The division also assigned Roland J. Voith and Edward M. Joyner, electrical engineers, to the Chicago and Atlanta district offices, respectively.

Benjamin Electric Manufacturing Co, Des Plaines, Ill., has appointed Oliver C. Westberg, presently the firm's sales representative in St. Louis, to the post of Pacific Coast division manager. He succeeds Carl O. Martin who retires after having served the company 41 years, the last seven as Pacific Coast division manager. The Pacific Coast division has been divided into three districts: Southern, Northern, and Central. G. A. Hochenauer was appointed manager of the Southern district, which includes the lower half of California and the state of Arizona. The districts' headquarters is located at Los Angeles. From Seattle, Wash., headquarters, Henry Huber will serve as manager of the Northern district, which comprises the states of Oregon, Washington, Montana, and northern part of Idaho. John Keyes will manage the Central district from headquarters at San Francisco. The district's territory covers northern half of California, states of Utah and Nevada, and part of Idaho, including Boise and Pocatello.

Westinghouse Electric Corp's Air Conditioning Division has named James C. Reynolds manager of its newly created Central district. Reynolds, who joined Westinghouse in 1941, will be responsible from his Pittsburgh, Pa., headquarters for sales of the firm's air conditioning products in Ohio, West Virginia, Kentucky, western Pennsylvania, and most of Michigan and portions of Maryland and Indiana. Westinghouse's Lamp Division has appointed Joseph F. Kempf, Jr., as manager of its Lake Erie district to succeed L. W. Auckland. Operating from headquarters in Cleveland, Kempf will direct the Lamp Division's sales activities in northeastern Ohio.

REPRESENTATIVES

Kuhlman Electric Co has appointed Maydwell & Hartzell, Inc, San Francisco, as Western sales agency for its Transformer Division. The West Coast organiaztion, which will serve Western transformer users, has branch offices in Seattle, Spokane, Portland, Los Angeles, San Diego, and Phoenix.

T. J. Cope, Philadelphia, has designated the Bradley Co, Philadelphia, as sales representative for its complete line of cable trough and cable installation equipment. The territory to be covered will include eastern Pennsylvania, southern New Jersey, and Delaware.

Another reason why
UTILITIES EXPECT MORE FROM **POWERS** *American*

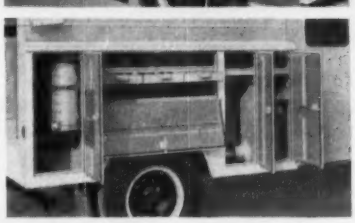
The Ultimate in Line Construction Equipment

MANAGEMENT
likes the 800-C because it saves man-hours—furnishes crew comfort—provides a safe, durable, low-upkeep unit for heavy work.

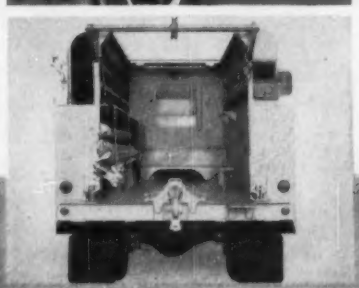
SUPERVISORS
like the 800-C because it's a completely equipped body that's easy to load—easy to use—easy to inventory.

CREW MEMBERS
like the 800-C because it keeps tools and supplies in easy-to-find order. And, with a Pole-Master, it's a lineman's dream.

All shelves and parts bins are standard equipment. Street-side doors open 180° for easy access to all compartment space.



Sliding drawers are furnished in curb-side compartments. All door locks are keyed alike. Crew enclosure seats four.



56" wide cargo area provides space for miscellaneous supplies. The body can be equipped to meet individual needs.

Utility operators indicate that the 800-C is destined to set a new standard for line construction vehicles.

It furnishes the storage space—the crew facilities—and the equipment for handling the most rugged types of routine or emergency line work. And, when equipped with a *Pole-Master* fully-powered, live-boom derrick—as shown above—crews can set poles up to 75 ft. in length.

The Series 800-C in 11′, 12′3″, and 13′ lengths—and the Series 800 (without crew enclosure) in 11′ or 12′6″ lengths—can be furnished with *Pole-Master* or conventional derrick.

COMPLETE DETAILS and prices are yours for the asking.

Powers-American Division

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO. 426 LATHAM SQ. BLDG. • OAKLAND 12, CALIF.

NEW EQUIPMENT

Universal Crimping Tool

Universal crimping tool is constructed of high-strength steel alloys. It has rubber hand grips, but is also available with wooden handles.

This MD3 Hytool is designed to install all compression service connectors in the Burndy Crimpit line. Four separate crimping grooves accommodate a wide range of conductor and connector sizes. The tool features a compound cam-and-toggle action that develops a high mechanical advantage and delivers 9,000 lb of indenting force with a single stroke.

The MD3 weighs 8 lb, and is 24 in. long. Further details available on request.

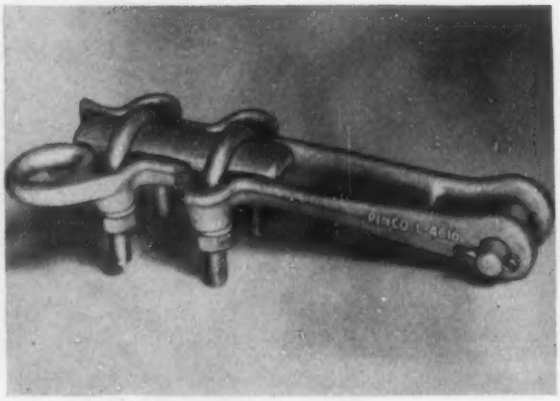
Burndy Engineering Co, Inc, Norwalk, Conn.

Straight Line Clamps

Line of malleable iron, straight line clamps are said to have increased gripping surface on the conductor, and to be easily blanketed. Cable seat of each clamp will accommodate a range of conductors, simplifying stocking.

Cable size ranges from 0.16 to 0.80 in. minimum and from 0.38 to 1.56 in. maximum. The larger clamps, Pinco L-4619, L-4620, and L-4621, will accommodate 1,750,000 CM copper conductor. The L-4609 light weight, single U-bolt clamp is designed for small conductors, 0.16 to 0.38 in., under light loadings. Ultimate strength ratings range from 7,000 lb for the light weight clamp, to 17,000 lb for the three larger clamps.

Porcelain Insulator Corporation, Lima, N. Y.



Radio Base Stations

Type MCA 151-A base station is for two-way FM communications in the 25-54 Mc band. Mult-frequency operation up to 4 channels within band of 1% of carrier frequency is available. Station is self-contained, providing transmission, reception, and termination facilities. Termination panel permits remote operation through 2-wire or 4-wire telephone lines. The unit has provision for a second receiver for dual-frequency reception. Power output is 50 w (25-45 Mc) or 40 w (45-54 Mc) for continuous duty. Input is 117 v, 50/60 cps, 150 w on standby, 325 on transmit.

Type MCA-450-A and MCA-451-A are for 450-470 Mc operation. The 450-A operates in the 450-460 Mc commercial band, while the 451-A operates in the 460-462 and 468-470 Mc Class A citizens' band. Multifrequency operation is available up to 4 channels selected within a 1 Mc band. Power output is 17.5 w for the 450-A, 12 w for the 451-A.

Allen B. Du Mont Laboratories, Inc, 750 Bloomfield Ave, Clifton, N. J.

Insulating Spray

Air-dry coating, E-26, has desirable physical, chemical, and electrical characteristics. E-26 can be sprayed on from push-button Spra-Tainer. Each stroke provides a coat 0.75 mils thick —film can be built up by repeated application. Dielectric strength is 800 to 1,200 v per mil. Test information is in Bulletin E-26.

Insl-X Sales Company, 26 Rittenhouse Place, Ardmore, Pa.

Packaged Servo

Complete packaged servo systems, including amplifier, motor, and gear train, are engineered for minimum space requirements, ease of adjustment, and plug-in adaptability. Suggested applications include synchro

DESIGN FEATURES

- One-piece construction in all lengths to 40 ft. No longitudinal seams or transverse joints.
- Heat-treated alloys used throughout, give consistently uniform high strength.
- Designed for either overhead circuits or underground wiring.
- Venetian column type of taper acclaimed by architects.
- No forms or mandrels used to shape pole. Taper can be varied to suit individual requirements.
- Light weight cuts installation cost.
- Entire surface ground to mat finish which gives best surface for non-reflecting, durable oxide film.
- No painting needed at any time. Saves maintenance cost.

SPECIFICATIONS

Standards available up to 40 ft. in height, with Standard Base or Transformer Base.

Brackets from 3 ft. to 15 ft., in round or oval cross-section, with 1¼ in. or 2 in. slip fitter or threaded ends.

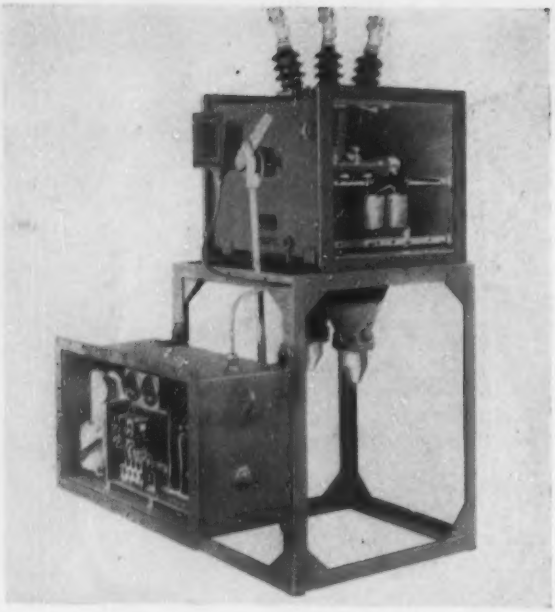
Handholes, Pole Top Pin Assemblies, Ballast Attachments, Spreader Arms, Levelites, and other accessories available.

HUBBARD ALUMINUM PRODUCTS COMPANY

MANUFACTURERS OF HAPCO QUALITY ALUMINUM PRODUCTS

A Division of HUBBARD and COMPANY

6301 Butler Street • Pittsburgh 1, Pa.



Automatic Feeder Transfer

Automatic operating mechanism, Model F, for feeder transfer switches, automatically transfers the load from preferred feeder to emergency feeder when preferred voltage fails. It throws back automatically when the preferred feeder voltage is restored. The mechanism is for oil switches, either double-throw or two single-throw units.

The mechanism is in a watertight sealed housing. The unit is mounted on the steel supporting frame of G&W Type RA oil switches in 5, 7.5, and 15 kv ratings.

With Circuit F6, either feeder may be selected as the preferred source by manually operating a remote selector control switch. With Circuit F3A, the load is held on the emergency (after throwover) until a push button is manually operated. With Circuit F3B, for use with diesel generator as the emergency, throwover is delayed until diesel is started and generator has built up voltage. Using Circuit F3C, with current transformers and latching relays, throwover is blocked in case of a short on the load side.

Mechanical and electrical details in Bulletin DA-F.

G&W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

data transmission systems, follow-up systems, laboratory and industrial instrumentation, simulators, automatic systems, etc.

Model 601.5 operates on 58-62 cps and has 1.5 w power output. Input impedance is 1 megohm. The loop gain is adjustable to 0.014 in.-oz/mv error times the gear ratio. Model FB4001.5 is for 396-404 cps operation. The amplifier measures 5⅝ x 4½ x 2⅞ in. The motor is 3 in. long by 1⅞ in. diam. Four miniature radio tubes are used.

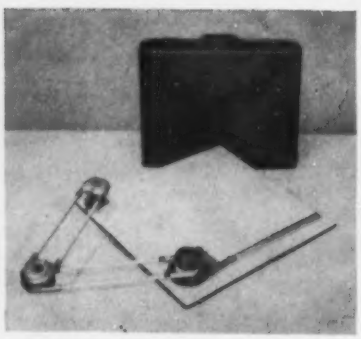
Feedback Controls Inc, 1332-34 North Henry St, Alexandria, Va.

Fluorescent Flood Light

High pole-mounted fluorescent flood light is designed for service station lighting. This 9000 Series luminaire projects a broad long-throw beam of white glareless light over driveways, ramps, and approaches.

It is for use on existing poles. Watertight housing is welded, die-formed aluminum, while frames holding either Plexiglas or Alba-Lite glass are of extruded aluminum. Mounting arm is adjustable to 10, 20, 30, or 45 deg from horizontal. Unit is 75 x 16½ x 8⅜ in. Four 100-w rapid-start lamps are used.

Guardian Light Co, 500 North Blvd, Oak Park, Ill.



Drafting Machine

The Universal Desk-Topper Drafting and Layout Machine is a personal drafting system that can be used most anywhere. The machine has a folding board, paper dispenser, instrument box, and carrying carton or travel case. Drawing capacity is 22 x 34 in.

Machine has 360-deg, 4-in. protractor with 15-deg automatic indexing. Entire system will fit into a desk drawer. Folder available.

Universal Drafting Machine Corp, 7960 Lorain Ave, Cleveland 2, Ohio

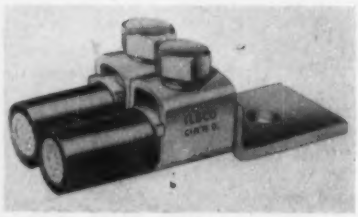
Ionic Air Cleaners

The "Built-Up Line" of ionizing-type air cleaners features all-aluminum framework. Claimed efficiency of cleaning is over 90%. Units may be "built-up" for capacities of 1,350 cfm (Model B-102) to 59,600 cfm (Model B-811). Selenium rectifiers are used for the high-voltage dc.

Power input is 110/120 v, 50/60 cps, single phase, 40 w for first 1,000 cfm and 10 w for each additional 1,000 cfm. During a 2 minute washing cycle, 2 gpm of 125 F water is required per 1,000 cfm capacity.

The "Custom-Line" units are packaged air cleaners available in sizes up to 12,600 cfm at 90% efficiency. For more details ask for Catalog CB-20.

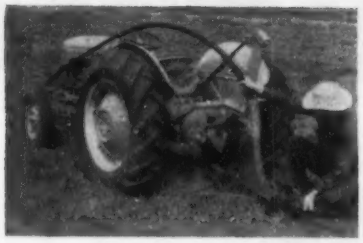
Electro-Air Cleaner Co, 1285 Reedsdale St, Pittsburgh 33, Pa.



Multiple Lug

Multiple lug, LU-2, will take a wire range from two 4/0 to two 1/0 cables. Wires are wedged between arched pressure bar and V-bottom collar. Positive contact at all times is claimed. Solderless connnections are made with a socket wrench.

Ilsco Copper Tube & Products, Inc, Cincinnati, Ohio



Cable Layer

Pipe and cable layer attaches to tractor and will put flexible cable or piping up to 1½ in. diam into the ground up to 18 in. deep. A subsoiler with a guide tube conducts cable into the ground. Guide rings mount on the tractor for conducting the cable back to the guide tube.

In operation, an exploratory subsoiling pass is first made with the tractor and subsoiler over the projected route to clear rocks, roots, or other obstructions. The cable is then laid out alongside the cut and is threaded through the two guide rings on the tractor, and the guide tube on the subsoiler.

Ferguson Div, Massey-Harris-Ferguson, Inc, 172 Packard Ave, Racine, Wis.

Glass Tape

Line of all-purpose woven glass tapes, the Hesgon Series, is for wrapping field coils, armature coils, and stator coils in dc motors and generators, and in ac induction motors, synchronous motors, and generators. Tape is in standard width from ½ to 1½ in., from 0.0004 to 0.015 in. in thickness, and in medium or close weave constructions.

Hess, Goldsmith & Co, Inc, 1400 Broadway, New York, N. Y.

Steam Generator

Line of electric steam generators incorporate in a single boiler drum a self-regulating control. Steam is generated by the resistance of the boiler water to electric current between metal electrodes. The balance control, without pressure switches or magnetic contactors, continuously and automatically regulates the input of electric power to balance the steam load, and maintains non-fluctuating steam pressure. These Speedylectric packaged boilers, Series BBC (Built-In Balanced Control), require about ½ sq ft of floor per boiler hp.

The steam generators come in sizes from 1½ to 60 Bhp and pressures to 500 psi, and operate at 98½% efficiency and 100% pf. Inputs available are 220, 440, or 550 v ac, single or polyphase.

Livingstone Engineering Co, 100 Grove St, Worcester, Mass.

Cathodic Cable

Type CP direct-burial cable is for use in cathodic protection systems. The CP cables are available in sizes 8 through 4/0, single conductor, 600 v. Cable can be rubber-neoprene construction, Anaconda's Durasheath, or the new Type CP with all-plastic polyethylene insulation and red PVC jacket.

Anaconda Wire & Cable Co, 25 Broadway, New York 4, N. Y.

Engine Safety Panel

Safety panel for unattended or remote-controlled engines is designed to protect against burned bearings, frozen pistons, or other costly failures. The panel for engines with battery ignition consists of an oil pressure gauge and water temperature gauge in combination with an engine shut-off switch; an ammeter; stop switch and re-set and 14-amp fuse. Other panels for magneto ignited and diesel engines are also available.

Should oil pressure drop too low or engine temperature rise to a dangerous level, the panel automatically shuts off the engine. The position of the "stop" on the face of the gauges

(*Continued on page* 156)

Shielded-Arc Welding for Mild Steel

Consumable-electrode, shielded-arc process for welding mild steel from thickness of 1/16 in. up produces welds that can be painted without cleaning. There is said to be virtually no spraying or splatter, nor any slag on the weld. The process uses welding grade argon, a new coated wire (West-ing-arc MS-20), a newly designed welding gun, wire control, and a constant-potential power source (RCP, 500 amp, dc arc welder).

West-ing-arc MS-20 wire is a special mild steel electrode in four sizes from 0.040 to 0.091 in. The coating is claimed to stabilize and control the arc so that straight polarity (electrode negative) welding may be used, resulting in higher burn-off rate and higher welding speeds. About 30 cu ft per hour of argon is used. The good arc stability results in this low consumption of shielding gas. A 25% overall saving in cost is claimed for semi-automatic welding over manual methods.

Electrode gun is rated 500 amp and delivers wire, power, gas, and water. Its tip is water-cooled. The wire is fed at a constant, pre-selected speed. Input to control panel is 110 v ac.

The welder (RCP) is a constant-potential power supply rated 220/440 v, 60 cps, 3 phase input and uses a selenium rectifier. Output continuous current rating is 500 amp at 34 v. Drop from no load to full load is 6 v. A calibrated dial adjusts output from 15 to 40.5 v. Efficiency is 82% and pf is over 95% at rated load.

Westinghouse Electric Corp, Arc Welding Dept, Buffalo, N. Y.

EXTRA

If you are now faced with a contamination problem in a particular area and would like more information regarding the Pinco 1925 "Universal" Insulator—then drop us a line or contact The Joslyn Manufacturing & Supply Co. office in your locality.

PINCO
INSULATORS

RIGHT ON THE JOB—

COVERAGE is important in insulators too . . .

. . . which in the case of Pinco 1925 "Universal" Insulators means increased leakage distance plus added protection against air-borne contamination.

HERE ARE THE FACTS:

1 Leakage distance of 17" is approximately 50% greater than a standard 10" suspension unit.

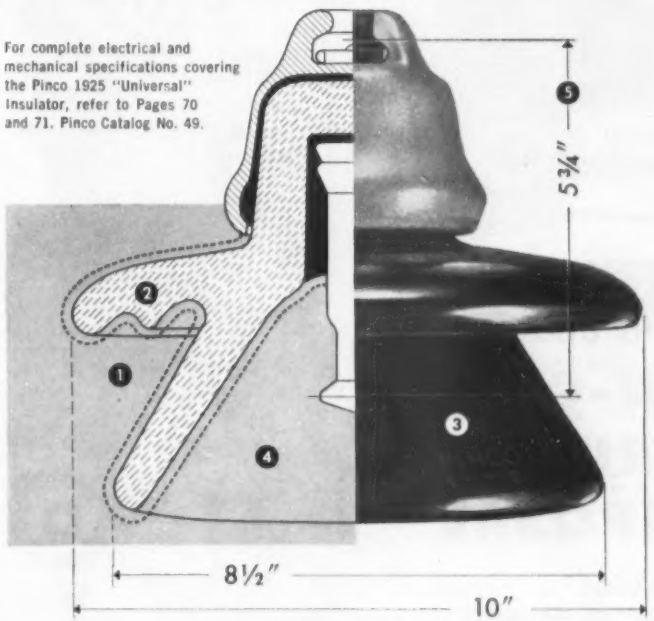
2 Upper shell being larger diameter (10") protects lower section (8½" diameter) from cumulative rain drip — thus providing EFFECTIVE leakage distance.

3 Long, tapered hood is self-cleaning; acts as a splatter-baffle to clean the petticoats.

4 In strings, interior of hood is shielded by unit below—protected against contamination, thus reducing manual cleaning requirements to a minimum.

5 Standard 5¾" spacing permits replacement of conventional 10" suspension units without re-sagging.

For complete electrical and mechanical specifications covering the Pinco 1925 "Universal" Insulator, refer to Pages 70 and 71. Pinco Catalog No. 49.



Here is how Pinco 1925 Insulators rated in a competitive "fog operation" test conducted by a western utility . . .

FIRST	on "fog arc over"	FIRST	on both self-cleaning and manual cleaning characteristics
FIRST	on sustained voltage "in fog" . . . No arc over	SECOND	on "sluice arc over"
FIRST	on sustained voltage "in direct spray" . . . No arc over	EXCELLENT	on radio interference characteristics

The Porcelain Insulator Corporation

LIMA, N.Y.

Suspension Insulators . . . Clamps and Fittings

Switch and Bus Insulators . . . Distribution and High Voltage Pin Types

Guy and Tree Insulators . . . Special Porcelain.

Save–

MAN HOURS
HAULING
BURNING

New, FREE BOOKLET
tells about
LOW-COST BRUSH DISPOSAL

Read how leading tree surgeons, power companies, municipalities, utilities use Fitchburg Chippers to cut disposal costs up to 50%—create customer good will.

Whatever your brush disposal problem, you will more than likely find the answer right in this new booklet, packed with valuable facts, specifications, and suggestions.

Learn how a Fitchburg Chipper can increase the efficiency of your operation. Mail the coupon for your Fitchburg Chipper booklet today.

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FITCHBURG ENGINEERING CORPORATION
Dept.1611, Fitchburg, Massachusetts
Send me the New Chipper Booklet!

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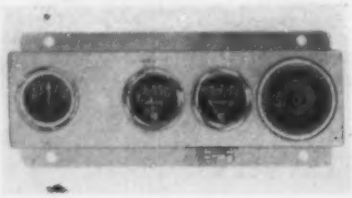
New Equipment

(*Continued from page* 153)



pre-determines the minimum oil pressure or maximum engine temperature at which it is desired to shut off the engine. The stop positions may be adjusted by a regulating screw on back of instrument. Electrical contact points on the gauges are silver. The panel measures 12 x 5⅛ x 2⅝ in.
Stewart-Warner Corp, 1826 Diversey Pkwy, Chicago 14, Ill.

Catalyst Spray Gun

Catalyst spray gun will simultaneously spray plastic resin and catalyst and is claimed to assure a uniform mixture of resin and catalyst. It eliminates the practice of mixing small quantities of catalyst and resin and speeding application before setting action takes place.

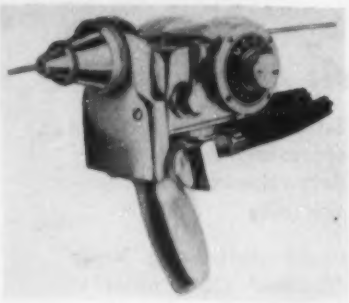
The resin is fed to the gun through the fluid line and the catalyst is introduced through the air stream. When the gun trigger is actuated, catalyst and resin meet outside of the air cap and are atomized uniformly. Gun has single pressure control for resin and a double pressure control for catalyst (which is the governing agent in setting the resin). Atomizing air pressure control is also dual.
DeVilbiss Co, 300 Phillips Ave, Toledo 1, Ohio

Metallizing Gun

Metallizing gun may be used for production, maintenance, and anti-corrosion spraying applications. Weighing 5½ lb, the Turbo-Jet metallizing gun may be tool post or hand operated.

The gun will spray a fine, dense coating using wire from 20 gauge to 3/16 in. and will spray both hard and soft metals. Dual feed rolls provide positive wire feed.

The gun will operate on acetylene,



propane, or natural gas at 15 psi. Magnetic controlled governor gives controlled turbine power using 60 psi air with a wire speed range from 2½ in. per minute to 20 fpm. Literature available.
Metallizing Company of America, 3520 W. Carroll Ave, Chicago 24, Ill.

Hot-Water Truck Heater

Hot-water heater is for crew compartments of line trucks. The Model ES-18 heater has an output of 25,850 Btu. The heaters are cut into the truck's cooling system in parallel—the regular cab heater is not dependent on the crew compartment heater. The heater contains a die cast magnesium 8-in. fan.
Evans Products Co, Plymouth, Mich.

MORE NEW PRODUCTS
about which you should know

Crouse-Hinds Co, Wolf at Seventh North St, Syracuse, N. Y. has explosion-proof pendant **tank light** (Type EV 2375), 75 w, for Class I, Groups C and D; and Class II, Groups E, F, and G locations.

United States Rubber Co, Rockefeller Center, New York 20 has lead-cured, wear-resistance U. S. Royal Master **Portable Cord** for use on electrical machinery. U. S. Rubber also has UL-approved **spark-proof flooring** of conductive synthetic rubber and fabric.

Coming New Equipment

Received Too Late For This Issue

Roller-Grip Clamp

Paul S. Everley Co—for strands and cables, is re-usable

Packaged Microwave

Raytheon Mfg Co—system has two channels for telephones, etc.

Distribution Transformers

Westinghouse Electric Corp—have less weight, lower height

General Electric Co, Schenectady 5, N. Y. has strongbox industrial **solenoids** available in 9 basic frames, 24 different ratings . . . Control Systems Inc, Box 115, Brooklyn 14, N. Y. has Series 250 **voltage boosters,** fixed or automatic, 250 to 5,000 va, 115, 220, or 208/230 v ac.

I-T-E Circuit Breaker Co, Philadelphia, Pa. has Electro Clutch **electromagnetic clutches** for constant hp output, quiet operation, and rapid speed change.

Vickers Electric Div, Vickers, Inc, 1815 Locust St, St. Louis 3, Mo, has **dc power supplies;** 5, 7.5, 10, 15, 25, 37.5, and 50 kw; 125/250 v dc; 1% regulation; selenium rectifiers; magnetic amplifiers; metered; and fan cooled.

Air Reduction Sales Co, 60 E. 42 St, New York 17, has **ac welders;** 300, 400, 500 amp; moving coil primary.

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Subox Inc.

3 Fairmont Plant, Hackensack, N. J.

Next Steps in Atomic Progress . . . A Challenge to American Industry

The purpose of this editorial is to throw light on the significance for American industry of recent changes in the statutes that control the development of atomic energy.

The need for clear light on the meaning of this new legislation is made more urgent by the political confusion and distortion that marked its course through Congress. The politically inspired charges of "giveaway" that delayed its passage—charges that were almost totally unrelated to the legislation itself—helped to obscure the vital importance of the step finally taken by Congress.

In sober, post-Congressional fact, the principal significance of the new atomic legislation is that it extends to private enterprise responsibility for the development of peaceful uses of atomic energy, whereas heretofore this responsibility has rested in a tight government monopoly. **And this extension is made on terms that emphasize the responsibility far more than they open any opportunity for economic gain in fulfilling it.** The revised Atomic Energy Act provides that:

1. Industry may now own and operate its own nuclear reactors, under license from the Atomic Energy Commission. And it may build and sell nuclear reactors for export.

2. Industry may use—but not own—nuclear materials at the discretion of the Atomic Energy Commission.

3. The Atomic Energy Commission will make available to industry scientific knowledge that may be useful in developing peaceful applications of nuclear energy.

4. For the first time, industry will have the right to patent inventions in the field of nonmilitary nuclear energy. However, "basic" discoveries must be made available to all companies in the field for a period of five years, after which they, too, will revert to normal patent status.

Two Kinds of Know-How

These provisions, despite the imposed limitations, represent the first positive step toward development of nuclear energy for peaceful applications in the United States. Potentially useful knowledge, previously locked in the minds of government scientists, will now be available to all those who are willing and able to put it to work for the good of mankind.

The advantages to be gained from enlisting the talents of American industry in the development of peaceful atomic applications are imposing. As *The* (London) *Economist*, Europe's leading economic journal, recently remarked, "The atomic scientists are in a position to surmise how atomic energy can be applied... but they lack the specialized knowledge of engineering design and operating technique just as industry itself lacks atomic knowledge." Now the engineers of private industry need no longer lack the atomic knowledge, and there is granted to them at least a restricted freedom to apply it to the solution of their engineering and operating problems.

But the new opportunity for private industry to find constructive uses for the science of nucleonics carries with it a grave responsibility. These uses must be so developed that they will benefit the people of all the free nations. It is essential that the United States, which pioneered in developing lethal uses for atomic fission, demonstrate to the world our paramount interest in its peaceful application. It would be a moral set-back to the free world almost beyond calculation if the Communists should be able to offer to the poorer nations of the world the benefit of low cost atomic power — provided by Communist technicians — while we concentrate primarily on building our stockpile of atomic and hydrogen bombs.

Race For a Peaceful Victory

Most of the experts are agreed that it may be many years — perhaps ten, fifteen or more — before the cost of electricity from atomic fission can be reduced to a level that will make it competitive with conventionally produced power in most regions of the United States. But most of the world is not nearly so fortunate as we are in power resources. Electricity, even at a cost far higher than the average that prevails in the United States, would be a blessing in many countries, and the nation that provides the technology to bring it into being will score a great moral victory.

The useful potential of nuclear energy is not restricted to the generation of electric power — although twenty years from now this use will be highly important to the power industry of the United States. Even with the limited research that has been done in this field thus far, the use of radioisotopes — the radioactive products of atomic reactors — is saving American industry an estimated $100 million a year. Commissioner Campbell of the AEC, who made this estimate, believes that these savings may well reach $1 billion a year within ten years. Radioisotopes are already at work in industries ranging all the way from paper manufacturing, where they measure paper thickness, to pipeline transportation, where they mark the dividing lines between shipments of different products (at an estimated saving of $500,000 a year). Medical applications of these same radioisotopes hold promise of longer and more comfortable lives for those who are stricken by cancer and other diseases.

Above All a Challenge

The new Atomic Energy Act is a crucial stride toward the day when all these benefits — and undoubtedly others not yet revealed by research — will be realized. But it is a step that is essentially permissive. It still leaves it to private industry for the most part to decide what is to be done and how soon.

The new act is thus, above all, a challenge. It confers on private industry the responsibility to assume a leading role in the development of peaceful uses for nuclear energy, a step long urged by NUCLEONICS, a McGraw-Hill magazine devoted to atomic energy. To achieve a success in this task that will measure up to the requirement of the national interest, this development must command all the resources and ingenuity that private enterprise can apply — and do so without promise of glittering prizes surely to be won. **But now that the responsibility has been defined and the challenge offered, American industry will, we believe, measure up to its grave and mighty import.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

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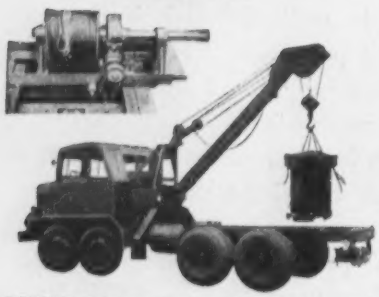

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CATALOGS • BULLETINS

● **ANODIC PROTECTION:** Protection of commercial and industrial black iron hot water tanks with magnesium anodes is described in The Magnesium Anode, Vol. 4, No. 3 (4 pages). Dow Chemical Co, Midland, Mich.

● **GE BULLETINS:** Following are available from General Electric Co, 1 River Rd, Schenectady 5, N. Y.:

● GEA-6195 Electric Equipment for Heavy Construction Tools (8 pages).

● GEA-6196 Installed Electric Equipment for Heavy Construction Projects (4 pages).

● GED-1966A Electric Equipment for Process Industries (24 pages). Includes list of applicable GE bulletins.

● **CENTRAL PLANT:** A 24-page, trilingual booklet shows "1953 Activities" of the company: manufacture of power plant, handling equipment, boiler work, etc. Societe Des Forges et Ateliers du Creusot, 15 Rue Pasquier, Paris 8.

● **HYDRO AND STEAM PLANTS:** Cranes, gates, hoists, penstocks, pipe, valves, and other units requiring engineering design and fabrication and machining of heavy plate are shown in 28-page book: Custom Designed Equipment for Hydro-Electric and Steam Power Plants and Water Works. Pacific Coast Engineering Co, Alameda, Calif.

● **POWER PLANT:** A 40-page brochure illustrates the services offered by GAI: engineering, construction, research, etc. Gilbert Associates, Inc, 607 Washington St, Reading, Pa.

● **INDUSTRIAL MODELS:** An 8-page brochure shows typical engineering models built to scale by Industrial Models, Inc, 2311 Sconset Rd, Wilmington 3, Del.

● **CENTRAL STATION CONSTRUCTION:** A 45-page book, "Dravo—Engineering Constructors," describes services and activities and shows power plants and typical utility central station projects completed. Machinery Division Construction Dept, Dravo Corp, Dravo Bldg, Pittsburgh 22, Pa.

● **HEAT-EXCHANGE EQUIPMENT:** Bulletin PB-290 (36 pages) shows heating, air conditioning, ventilating, and heat transfer equipment. The Trane Co, La Crosse, Wis.

● **ALUMINUM PROTECTION:** A 4-page folder covers Alodizing with Alodine for protecting aluminum or providing a paint base. American Chemical Paint Co, Ambler, Pa.

● **COOLING TOWERS:** Cooling Water for Industry (CT-ID-0.002, 36 pages) describes induced-draft cooling tower construction. Fluor Corporation, Ltd, 2500 S. Atlantic Blvd, Los Angeles 22, Calif.

● **WATER:** Water in Process Use (folder) discusses the laboratories services in boiler water conditioning, procurement, treatment, use, and disposal of industrial water. Hall Laboratories, Inc, Hagan Bldg, Pittsburgh 30, Pa.

● **PRESSURE FILTERS:** Bulletin 2225-B, 16 pages, describes line of pressure filters and accessories. These filters are used to remove suspended solids such as dirt, turbidity, iron, oil, and color. The Permutit Co, 330 W. 42 St, New York 36, N. Y.

● **WATER CONDITIONING:** Publication 6210 (4 pages) covers water conditioning equipment: demineralizers, softeners, deaerators, dealkalizers, filters, etc. Cochrane Corp, 3135 N. 17th St., Philadelphia 32, Pa.

● **EXCAVATING EQUIPMENT:** General Catalog GC-5A, 80 pages, covers excavating, drilling, and material handling equipment. Specifications and typical examples of use are shown. Bucyrus-Erie Co, South Milwaukee, Wis.

● **HEAT-TREATING FURNACE:** Catalog TD-4-620(2), 12 pages, covers Microcarb atmosphere control for control of carbon potential in Homocarb furnaces. The method is for continuous, automatic measurement and control of active carbon inside the furnace retort during heat treating cycles. Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

TECHNICAL LITERATURE

AIEE—Following are available from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.:
● AIEE 801 Test Code for Aircraft Interrupting Devices, 8 pages. Price, 40¢
● ASA Y32.2-1954 Graphical Symbols for Electrical Diagrams, 58 pages. Price, $1.25
● ASA C37.13-1954 Low Voltage Air Circuit Breakers (Including Application Guide), 20 pages. Price, 80¢
● ASA C37.14-1954 Test Code for Low Voltage Air Circuit Breakers, 9 pages. Price, 50¢
● ASA C37.15-1954 Rated Control Voltages and Their Ranges for Low-Voltage Air Circuit Breakers, one page. Price, 30¢

ASTM BOOKS—Following are available from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.:
● ASTM Standards on Copper and Copper Alloys, 600 pages, 6 x 9, heavy paper cover. Contains all ASTM Standards pertaining to copper and copper alloys, including 108 specifications, 10 test methods, 2 classifications, 2 recommended practices, and a hardness conversion table. Price, $5.00 (Cloth cover $5.65).
● Symposium on Temperature Stability of Electrical Insulating Materials, 141 pages, 6 x 9, heavy paper cover. STP 161. Sponsored by Committee D-9 on Electrical Insulating Materials, presented at 57th Annual Meeting of ASTM, Chicago, June, 1954. Price, $2.75.

INDUSTRIAL FILMS—The 1954 supplement to the Industrial Film Bibliography names 240 new films available for business and industrial presentation. The bibliography covers motion pictures, sound slidefilm, and silent filmstrip. Price for the supplement, $1.00; both Industrial Film Bibliography and supplement, $2.00. National Metal Trades Assn, 122 S. Michigan Ave, Chicago 3, Ill.

SAFETY FILMS—Two, 12-min films are available as 16-mm sound movies or 35-mm sound slidefilms. "Take Time to Live" tells how one worker found a safer schedule by allowing 5-minutes extra a day to avoid accidents caused by hurrying. "If You Took Your Family to Work" shows how a worker's attitude changes when he realizes that his safety is of concern not only to himself but also to those near and dear to him. Rental, $10.00 each; sale, $106; twice these prices to non-members. National Safety Council, 425 N. Michigan Ave, Chicago 11, Ill.

ELECTRONIC CONTROL—The Electronic Control Story, 24 pages (F6437), covers fundamentals of electronic temperature control and application. Includes coverage of bridge circuit, sensing elements, type of control, on-off control, proportioning control, humidity control. Barber-Colman Co, Rockford, Ill.

BOOKS

Received Since August 30.

An Introduction to Power System Analysis. By Frederick S. Rothe. Published by John Wiley & Sons, New York 16, N. Y. 187 pages, illustrated. Price $5.00.

Audels Home Appliance Service Guide. By Edwin P. Anderson. Published by Theo. Audel & Co, New York. 824 pages, illustrated. Price $4.00.

Communication Theory. By Willis Jackson. Published by Academic Press Inc, Publishers, New York 10, N. Y. 532 pages, illustrated. Price $11.00.

Dielectric Materials and Applications. Edited by Arthur R. von Hippel. Published by John Wiley & Sons, Inc. New York 16, N. Y. 438 pages, illustrated. Price $17.50.

Control-System Dynamics. By Walter R. Evans. Published by McGraw-Hill Book Co, New York 36, N. Y. 282 pages, illustrated. Price $7.00.

Dielectrics and Waves. By Arthur R. von Hippel. Published by John Wiley & Sons, Inc. New York 16, N. Y. 284 pages, illustrated. Price $16.00.

Electric Transmission & Distribution. By G. A. Skrotski. Published by McGraw-Hill Book Co, New York 36, N. Y. 448 pages. Price $7.50.

Transformer Design

Betrieb und Anwendung von Leistungs- und Regeltransformatoren. By F. Ande. Published by Springer-Verlag, Berlin W 35. 319 pages, illustrated. Price 33 DM

Comprehensive discussion of the principles and design of power and regulating transformers comprises the scope of this new German book. Extensive resort to schematic and vector diagrams facilitates use of the information even by one not versed in German. Thoroughness of analysis is characteristic of the treatment at such points as the tap changer transition mechanism. Harmonic compensation is extensively discussed as is cooling and the resort to the Buchholtz relay.

Wiring

Electrical Contractor's Annual. By J. Rosslyn-Stuart. Published by E&F. N. Spon Limited, London, W.C., England. 358 pages, illustrated. Price 18s.

This is a second edition. It includes a series of articles covering specialized branches in the electrical contractor field such as: Main Panel Design for the Small Electric Installation, Lighting in Shops and Stores, Estimating and Costing for Contracts, Earth Leakage Trips, Television Servicing, Radio Interference Suppression, Wiring of Farm Buildings, etc. In addition to standard electrical data and information it has sections on New Equipment and Accessories and Trade Names and Addresses of Electrical and Radio Manufacturers which have been brought up-to-date.

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READERS FORUM

Thicker Ice and Greater Sag

To the Editor:

In my article, "Hosensack Joins 220-kv Systems," in the July 26 issue, a typographical error appears, that originated in my original draft of the article. The last two lines at the bottom of page 86 should have appeared as follows: "Maximum tension with 1-in. ice and 8-lb wind is 13,500 lb. Maximum sag at 120F is 3.44 ft." Instead they read, "Maximum tension with ½-in. ice and 8-lb wind is 13,500 lb. Maximum sag at 120F is 3.44 in.

Walter B. Morton
Assistant Electrical Engineer
Pennsylvania Power & Light Co
Allentown, Pa.

A Fountain of Praise

To the Editor:

Your Sept. 6 report, "Looking Over the Statistics of Cooling Towers," handles a complex integration of variables with the simplicity of a 2 plus 2 addition! But I feel your editorial section introduction (page 60) was an even more noteworthy job of piloting the reader through the shallow shoals of shortage-of-supply in the growing problem of industrial water requirements.

A shortage of supply of surface water can seldom be solved by drilling more wells or diverting stream flow. Many of the underground aquifers being "minded" are geologic phenomena and may not be recharged by natural percolation within our lifetimes. The processing industries, along with your power generating group, are aware of the importance of conserving available water and sharing the use of it with the other valid claimants. Growth of the industrial cooling tower business (from less than $1 million in 1933 to over $30 million in 1953) testifies to that.

President Eisenhower's recent appointment of a Cabinet Committee on the specific subject of water policy prelusively suggests the removal of water from its historic position in the "natural resource" category and its establishment as a "vital resource" (along with air). Your good book could go far in keeping industry aware of such developments.

Raymond C. Kelly
Executive Manager
Cooling Tower Institute
Palo Alto, Calif.

Get a Better Slogan or Support This One

To the Editor:

I was interested in the editorial in the Aug. 9 issue entitled "Industry Slogans." We certainly are thoroughly in agreement with the idea that we should have one slogan which expresses one big idea that everybody in the electrical industry can use effectively.

In our company we adopted "Live Better . . . Live Electrically" immediately following the war. We have paraphrased this to "Farm Better . . . Farm Electrically," "Sleep Better . . . Sleep Electrically," "Work Better . . . Work Electrically," etc. In the broad sense we believe that living better automatically includes working better in the field of non-residential, such as commercial and industrial organizations. Therefore, we think that "Live Better . . . Live Electrically" or the more recently adopted slogan of "Be Modern . . . Live Electrically" have closely met the needs of the industry.

Last year EEI adopted the slogan, "Be Modern . . . Live Electrically." It was the opinion of many manufacturers and others in the industry that it was a workable usable slogan. The adoption of the slogan by the industry has not been nearly as extensive as we had hoped.

Perhaps this is not the best slogan; and because it is not the best slogan, it is not extensively used. However, representatives of the PUAA and of a number of the appliance manufacturers believe that this is a good one. In lieu of a better slogan isn't it desirable to support this one?

Robert L. Coe
Residential Sales Manager
Union Electric Co of Missouri
Saint Louis 1, Mo.

York Haven not Lock Haven

To the Editor:

The item on page 8 of the Sept. 27 issue referring to power plant sites being investigated by Pennsylvania Power & Light Company should have read "York Haven" not "Lock Haven."

George M. Keenan
Vice President, Engineering
Pennsylvania Power & Light Co
Allentown, Pa.

Cooling Tower Cost Quicky Cut

To the Editor:

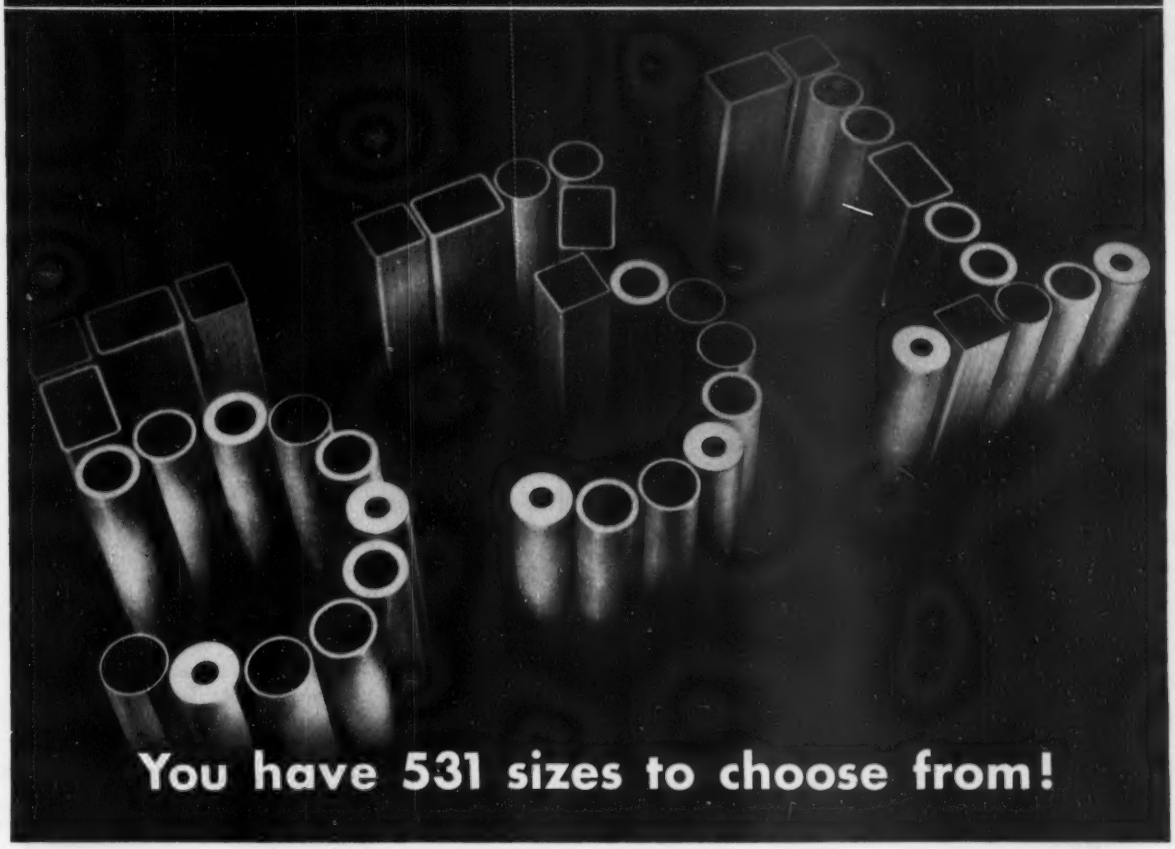
In reviewing the Sept. 6 issue, we noticed that the tabulation quoting our cost of cooling tower installations per kilowatt unit net capacity was somewhat high with respect to other installations.

The figure of $20.40 is the cost of cooling tower installation per kilowatt of initial net capacity and has no meaning as it is derived by dividing the approximate cost for five cooling towers by the initial plant capacity 49,000 kw. These five cooling towers actually serve a plant with a net capacity of 112,400 kw which makes the cost of cooling towers in dollars per kilowatt net capacity some $8.90 which is near to the average for other installations.

It is our opinion that this error would not have been made if the words "Present Capacity" had been used in place of the words "Initial Capacity" as there have been several additions to our plant since the initial installation.

W. V. Holik
Vice President
El Paso (Texas) Electric Co

WHY IT PAYS TO BUY MECHANICAL TUBING FROM US



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UNITED STATES STEEL

Innes, Associate Editor, Retires

Veteran of 29 years had directed coverage of sales and service activities. E. Bryson Sessions named as successor

FRANK R. INNES

Frank R. Innes, associate editor of Electrical World, retired today. His successor will be E. Bryson Sessions who joined the staff several months ago after several years with Utah Power & Light Co.

In his 29 years on the staff Innes held four positions, the first was assistant editor in 1925. The following year he went to Chicago as western editor. In this position he travelled extensively throughout the Midwest and in the Central South.

He returned to New York in 1939 as managing editor and directed the magazine during the rearmament program and during the early years of the war. In 1944 when it became evident that victory was not too long away, Innes was made associate editor to cover the load building activities that were certain to come with peace.

Directed 'Sell' Campaign . . . Since then he has been responsible for the Sales and Service Department as well as for many special issues in the fields of lighting, house heating, air conditioning, and uses of electricity on the farm. His "Sell—and Sell—and Sell" campaign of 1952-53 was followed by many appearances on the lecture platform.

Before joining the staff, Innes had a considerable knowledge of the utility industry which he entered in 1910 as a meter inspector for Detroit Edison Co. While engaged in this work, he invented an integrating volt-ampere-hour meter which is still being manufactured by Westinghouse Electric Corp.

In 1916 he became a distribution engineer and in 1919 entered the editorial and advertising department. Here he gained experience which was to prove valuable to him as an Electrical World editor.

Innes broadened his knowledge of industrial applications of electricity in 1925 when he joined the staff of the Sessions Engineering Co as an electrical engineer. This work took him to Washington where he supervised the electrical work going into many lumber mills.

Innes' Successor . . . Sessions, who is succeeding Innes, was graduated from University of Utah in 1949 where he majored in marketing. He joined Utah P&L as assistant editor of the house organ. Later as editor he was named "editor of the year" by the Society of Associated Industrial Editors.

While attached to the public relations department during the period that Pres George M. Gadsby was president of Edison Electric Institute, he gained a broad understanding of the industry from a nationwide viewpoint.

•

Robert J. Tallman has been appointed district manager of the Bonneville Power Administration at Wenatchee, Wash., to succeed **Howard Elmore,** who resigned to join the staff of the Chelan County PUD at Wenatchee. He formerly was customer-service representative in the Northwest area office in Seattle.

Joseph W. Rittenhouse has been named technical director of Hi-Voltage Equipment Co, Cleveland. Rittenhouse, who received an electrical engineering degree from Purdue University, joined in 1939 the James R. Kearney Corp, St. Louis. While there he spent five years in engineering and administration, and the last three years as New England district engineer. After leaving the Army, which he joined in 1943, he joined the University of Missouri, where he was associate professor of electrical engineering.

Executive Changes Made by Jefferson Electric Co

Jefferson Electric Co, Bellwood, Ill., has made these executive appointments:

Joseph G. Solari was elected vice president in charge of sales. John J. Brogan was made sales manager and William G. Lynch assistant sales manager, and Joseph J. Archibald, advertising manager, was assigned the additional duties of manager of consumer products for the Illinois company.

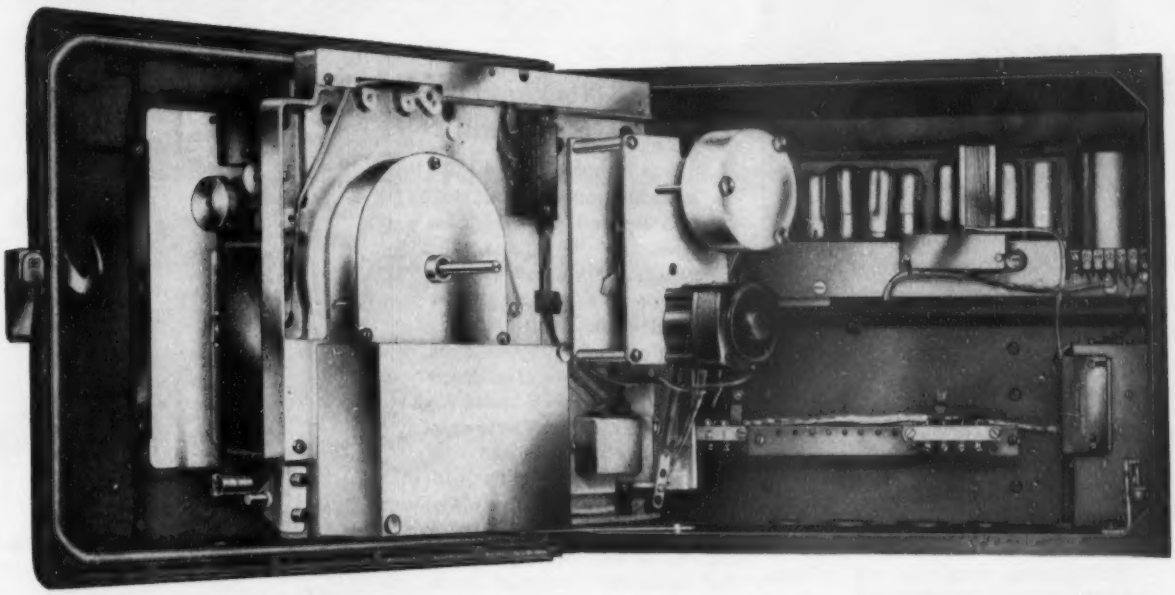
Solari formerly was vice president and assistant to the president of Peabody Coal Co, Chicago, for more than eight years.

Brogan, who joined Jefferson Elec-

JOSEPH G. SOLARI

tric 17 years ago, formerly served as the firm's Eastern district sales manager with headquarters in Boston. Lynch started his career with the company as a member of its manufacturing division in 1941, going later with the sales department. Archibald began with Jefferson Electric five years ago, becoming advertising manager last year.

WHAT'S NEW AT BRISTOL...



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Bristol's Dynamaster Potentiometers have earned a world-wide reputation for accuracy and dependability in recording, indicating, and controlling temperature, pH, speed, voltage, power, current, resistance, smoke density, strain – the list could go on and on.

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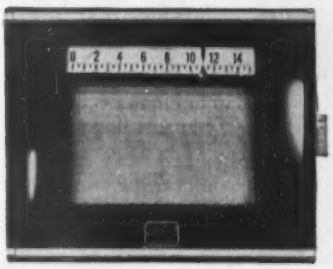
Get the whole story on these rugged, precision instruments. Write today for free 36-page bulletin P1245. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 4.26



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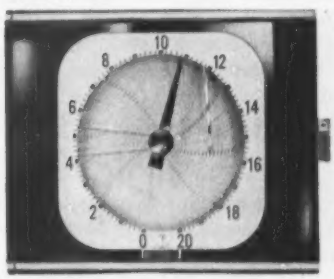

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ROBERT C. BLATT

Refrigerating Engineers Add R. C. Blatt to Staff

Robert C. Blatt today joined the staff of the American Society of Refrigerating Engineers as publications director. He will work out of the association's headquarters at 234 Fifth Ave., New York.

Blatt has been associate editor of Electrical World since 1949. He has covered the Southeast and directed the Industrial Applications Department.

Before joining EW, he had done editorial work for a number of aviation magazines. He acquired his interest in aviation in 1941-44 when he was chief airport lighting engineer for the Civil Aeronautics Administration.

Lighting was his field in his early days in the industry. Following graduation from George Washington University, he took the illumination course at the Edison Lamp Works at Harrison, N. J. In 1926 he became an illuminating engineer for Potomac Electric Power Co. In 1928 he was appointed chief electrical engineer for the municipal architect of the District of Columbia.

During this period he also served as a lighting consultant and designed and wrote the specifications for many large office buildings, stores, and apartments in the District.

•

E. S. Hight has retired as vice president and general manager of Illinois Power Co. He has been an employee of Illinois Power and its predecessor companies for over 44 years. During that time he held various positions, including the posts of chief engineer, assistant to the president, and vice president. He was made a member of the utility's board of directors in 1929.

Orange & Rockland Names Price to Operational Job

Appointment of Joseph W. Price as operating manager in charge of construction and engineering has been announced by Orange & Rockland Electric Co of Monroe, N. Y.

Price brings to his new post 24 years of domestic and foreign experience in power distribution construction and electrical engineering. Just recently he resigned as senior electrical engineer for the East Ocean Division of the Army Corps of Engineers.

Prior to his affiliation with the Corps, he was connected with Stone & Webster Co; E. C. Ernst, Inc, Washington, D. C., electrical contractors and engineers; Enterprise Electric Co of Maryland, Inc; Snell Electrical Construction Co of Vineland, N. J.; and Day & Zimmerman, Philadelphia consulting engineers.

Tacoma City Light Reveals Changes Tied to Dam Units

Several changes have been made in supervisory and engineering personnel in Tacoma, Wash., City Light, to expedite preparation of plans and construction of dam projects on the Cowlitz and Skokomish rivers.

Vivan B. Jones, power manager, was given additional duties as assistant superintendent of the Light Division. He will supervise all operational functions under Superintendent Henry A. Cole except engineering.

John D. Ferguson, supervising electrical engineer, was promoted to chief electrical engineer. He replaces A. D. Francis, who was transferred to project design and construction. Ferguson's former engineering post goes to Ronald M. Boyles.

Carl F. Pflugmacher was advanced to supervising civil engineer and will continue as acting project engineer in charge of project design and construction, pending appointment of a chief engineer for the two projects.

Roy K. Cramer, supervising civil engineer, and Harry M. Manning, power plant engineer, were assigned to project design and construction.

OBITUARY

Carl E. Arvidson

Carl E. Arvidson, 56, vice president in charge of electric production and transmission of Consumers Power Co, Jackson, Mich., died there Oct. 20.

Arvidson had been associated with Consumers Power since 1924. He had filled various positions in power sales, distribution, general engineering, electric construction, and production and transmission. From 1947 to 1950 he was the utility's general supervisor of electric construction. In 1951 he was named general supervisor of electric production and transmission after serving for a year as assistant general supervisor. Arvidson was elected a vice president by Consumers Power in 1952.

Vincent C. Brennan

Vincent C. Brennan, 58, vice president of personnel for Union Electric Co of Missouri, died Oct. 10.

Brennan's affiliation with Union Electric started in 1942 when he joined the utility as executive director of personnel. He was appointed vice president in charge of personnel in 1947. Prior to joining Union Electric, he had been in charge of personnel and industrial relations for Tidewater Associated Oil Co of New York.

The Union Electric official was active in committee work of Edison Electric Institute, having served on the industrial relations committee. During World War II he served on the industrial training panel of the War Production Board.

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Atomic Energy Parley

(*Continued from page* 69)

compares with 4 to 10 mills a kwhr for a steam plant, depending upon geographic location of the plant.

W. Kenneth Davis, deputy director of Atomic Energy Commission's Division of Reactor Development, told the group that a "down-to-earth" discussion of nuclear power costs is impossible to attain now for two reasons: First, lack of experience with power reactors, and second, classification of most of the pertinent cost data which prohibits their discussion in an unclassified meeting.

Davis said his concept of an economically competitive nuclear power plant is one which, when built and run under normal and appropriate industrial financing and operating practices, will produce power at the same or a lower cost than the best conventional power plant which could have been built instead at the same location and at the same time.

Nuclear power can compete with power generated by coal selling at $6 or $7 a ton, according to James A. Lane, director of the Oak Ridge National Laboratory's Reactor Engineering Division. He added, however, that the major initial costs of atomic power plants will be increased by the safety precautions necessary. Such measures, he said, may add about $1 million to the cost of a large plant.

Public Safety . . . The public safety aspect of reactor operations was discussed at a round table session by J. L. Gray, vice president of administration and operations of Atomic Energy of Canada, Ltd, and Reuel C. Stratton, assistant superintendent, Engineering and Loss Control Division, Travelers Insurance Co.

Canada's experience with a major reactor breakdown was related by Gray. He gave this account of the Chalk River plant failure:

The reactor breakdown, which occurred on Friday, Dec. 12, 1952, while experiments were being conducted at low power, was due to failure of the control system. This resulted in the release of very large amounts of radioactive materials and considerable physical damage to the reactor structure. Release of radioactive material through a 200-ft stack to the outside atmosphere was sufficient to require general evacuation

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Canadian Cable Characteristics

(*Continued from page* 80)

has been removed for a predetermined length and the outer layer shaved down for an equal distance. The ferrules have been designed for low specific current density at the interfacial planes between the aluminum alloy ferrule and the aluminum conductor. The aluminum alloy ferrules have the same electrical conductivity as the aluminum conductor, and their inside surfaces have been threaded and silver plated to prevent formation of an aluminum oxide film.

The conductor segments were tinned by the "friction" tinning method with a 90/10 tin-zinc alloy to keep the conductor free of oxide film during compression. The completed joint weighs about 600 lb and requires 41 canisters of jointing tapes of the same grade of paper as the cable insulant, except that they are pre-impregnated with a high-viscosity polyisobutylene, a mineral oil compound mixture. Joint sleeves are of aluminum alloy, and cast plumbs are used as the seal between sleeve and sheath.

Terminal Design . . . Porcelain terminal shells were subjected, on a 1½/40 wave, to ten negative and ten positive impulses of 1,030 to 1,040 kv crest, followed by ten negative and ten positive impulses of 1,110 to 1,120 kv crest, without flashover. Flashover voltage on a positive wave was determined to be in the order of 1,400 kv crest. The tests were conducted with oil inside the porcelain. Flashover tests on the porcelain shells filled with oil, at 50 cps with voltage raised at the rate of 5 kv per sec, established these values: Dry, 760 kv rms; wet, 605 kv rms.

Each terminal is 148 in. over all and weighs 3,000 lb. It withstood pressure tests of 150 psi hydraulic for six hours, and 100 psi pneumatic for seven days without failure. It has a stress control assembly of rather large proportions and ground shielding terminating in a lip flare. The terminal is protected from arcing discharges and steamers at the line voltage end by a spun aluminum corona shield.

Installation . . . The cable lengths were pulled into the tunnel from the switchyard end on to the cable hangers, using temporary rollers. Small field reservoirs on dollies traveled with each length, maintaining an oil supply after disconnection from the reel reservoirs. Once the three terminals in the transformer vaults were erected, jointing proceeded from the powerhouse end. The cables were individually clamped to provide a sliding pressure only at each hanger by means of hardwood clamps. Hardware, such as racks and hangers, is of pre-fabricated steel, and the terminal supporting structures of pre-fabricated aluminum.

The cable's 3.85-in. diameter required long offsets at the joints, which were positioned 2 to 3 ft in the vertical plane above their respective cables, and a minimum bending radius in this plane of 100 in. was set up, with a length of offset greater than 110 in.

For the permanent oil supply to the cables, pre-pressurized reservoirs of the AC type were used. These were located in the transformers vaults. Each reservoir has an active oil capacity of some 12 imperial gallons between 15 and 65 psi. Four reservoirs per phase were manifolded together to provide oil and connected to low and high pressure alarm devices.

Nashville Power Board

(*Continued from page* 74)

remain with the city—probably with the public works division—and 19 will transfer to NES.

The city Civil Service Commission announced that employees under 60 years of age will be permitted to withdraw all contributions to the retirement fund and join the NES pension program. Those employees over 60 transferring to NES will be allowed to continue contributing to the city pension program.

FINANCIAL BRIEFS

New York Life Insurance Co has purchased 59,600 shares of 4.20% preferred stock of the Illinois Power Co.

New England Electric System stockholders subscribed to 836,867 common shares of the 910,883 shares offered on a 1-for-10 basis at $15 a share. Balance of 74,016 shares were disposed of by the underwriters headed by Blyth & Co.

Middle South Utilities, Inc, has opened stock transfer facilities in Boston, Mass., in recognition of the benefits which will accrue to the large number of its stockholders in New England, E. H. Dixon, president, announced recently.

Blyth & Co sold a secondary offering of 2,500 common shares of Northern Indiana Public Service Co at $30.50 a share . . . **Northern Indiana Public Service Co** has placed privately $10 million first mortgage 3⅛% bonds due 1984 through Central Republic Co.

Central & South West Corp will pay Nov. 30 a quarterly common stock dividend of 33¢ a share compared with 28¢ previously.

New York State Electric & Gas Corp is buying all the electric facilities of the Paul Smith's Electric Light & Power & Railroad Co for about $42,000.

Southeastern Power Administration has reported revenues of $2,646,638 for fiscal 1954 as compared with $1,381,234 for fiscal 1953.

Florida Power & Light Co has released its 1954 edition of "Fabulous Florida Facts and Figures." For copy write, H. E. Simpson, vice president and comptroller, Miami 30, Fla.

Patchogue Electric Light Co is planning to sell 750 shares of preferred stock with a par value of $1,000 a share.

Central Vermont Public Service Corp will pay Nov. 15 a quarterly common stock dividend of 23¢ a share as compared with 21¢ a share previously.

United Illuminating Co has sold privately $9 million of its 3% debentures due 1984.

of over 2,000 persons from the plant area. But, by the following Monday morning the contamination in the plant area had been cleaned up or isolated sufficiently so that all personnel could return to work.

Gray said the 1 million gallons of contaminated water which flooded the plant's basement was pumped to an emergency storage tank. The contaminated water was pumped via a 4-in. pipeline 6,000 ft long to a special burial pit prepared within the 10,000 acres controlled by the company. Thus, the activity has been safely retained in sand and clay particles. The reactor's calandria, or central vessel, was also buried in the company's active disposal area.

Although the breakdown seemed catastrophic, Gray noted that through the work of decontamination, dismantling and rebuilding the reactor, considerably more was gained than was lost.

'Insurance' Role Studied . . . In commenting on the relationship of insurance to safety of reactor operation, Stratton said the insurance industry is diligently studying this phase of the problem of commercial utilization of nuclear energy. He added, however, that complete absorption of the risk may eventually need some federal government participation.

Preliminary design of a nuclear reactor system which could generate electric power, "breed" new fuel for itself, and deliver by-products to waste tanks all in continuous processes was described by Dr Clarke Williams of AEC's Brookhaven National Laboratory, Upton, N. Y.

Dr Williams said the system, known as LMFR (Liquid Metal Fuel Reactor) would provide the first usage of a liquid metal alloy, in this case, uranium-bismuth, as the fuel stream to interconnect continuous processes.

Dr Chauncey Starr, manager of the nuclear engineering and manufacturing department of North American Aviation, Inc, told the conference, "There does not exist today an operating nuclear power plant which can produce power at a cost sufficiently low to represent a prototype for significant additions to existent generation capacity."

Factors in Locating Reactors . . . Many of the factors which affect the location of coal-fired plants will apply also to nuclear plants, Titus G.

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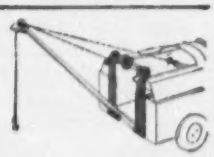


Derrick is locked in operating position.

C. V. MOREY, left, Consolidated Edison Co, and H. H. Marsh, Duquesne Light Co, chairman of the EEI and AEIC meter committees respectively, listen to an explanation by J. H. Patton, vice president, Sangamo Electric Co, of the new meter calibration system in background

Rising Load Obsoleting Meters

EEI and AEIC committees learn of meter retirement and replacement policies of utilities. Adequate wiring film shown

Meter obsolescence, extended range, and higher service voltages were focal points of the recent joint meeting of the Edison Electric Institute and Association of Edison Illuminating Companies Meter and Service Committees, Sept. 27-29, at Springfield, Ill. Other topics of interest were meter records and the safety and training of metermen.

Soaring residential loads have proved the inadequacy of 5-amp 2-wire meters. A survey of 67 utilities conducted by A. W. Rauth, Consumers Power Co, revealed that 49 have programs to retire these meters. Practices vary considerably, but most retirement programs are in conjunction with routine testing.

Some companies base retirements on actual economics, Rauth continued, evaluating loss of revenue for heavy consumption. One replaces meters manufactured prior to 1913 when monthly consumption exceeds 150 kwhr; another draws the line at 1927 for 330 kwhr.

Further discussion outside the meeting disclosed that today's emphasis on adequate rewiring has sounded the tocsin for most 2-wire meters and many earlier 3-wire types below 15-amp ratings. Estimates of number involved ranged as high as 20% of meters in service for some utilities.

Comments indicated virtual standardization on 15-amp extended-range meters, with some companies preferring a higher rating. And the new extended-range polyphase meter introduced by Westinghouse engineers was hailed by some delegates as opening the door to really universal metering where 3-phase 4-wire distribution can be anticipated.

Showing of "Magic Link," Consolidated Edison's new adequate wiring film, touched off extensive discussion of how to attain better customer installations. Some utilities indicated that service drops are being replaced with No. 4 equivalent to serve tomorrow's residential loads.

Metering costs must not be overlooked when evaluating higher service voltages, warned H. L. Miller, Houston Lighting & Power Co. A survey of 30 companies shows substantial use of metering transformers, said L. C. Ramon, Jr, New Orleans Public Service, Inc. But some replies indicate an inclination toward direct 480-v metering if the higher secondary voltage attains extensive use. Ramon implied that use of existing meters would be difficult and that changes in wiring standards and meter test intervals might be required.

Estimates of distribution investment savings at 277/480 v range from $14 per customer at present loads to $24 at double loads, continued Ramon. But A. J. Pansini, Long Island Light Co, urged adoption of 240/416 v for residential service. Reasons are economy, ability to retain present 240-v appliances, availability of 240-v designs for all present appliances, and possibility of international standardization of appliance voltage.

Meter Records Face Changes . . . Simplification of meter records for economy provoked extensive discussion. A survey of 62 utilities reported by E. H. Tyson, Pennsylvania Power & Light Co, disclosed that 23 meter departments have consolidated records with another department, usually with desirable gains. And 40 companies reported changes to simplify record keeping. The major difficulty seemed to be reconciling historical and calibration records desired by metermen with customer meter and billing records kept by accountants.

Motivation for this movement was pinpointed by Co-Chairman Morey. He noted the advances in machines for record-keeping, bookkeeping, and billing. But the annual cost for these machines justifies steps to use them as fully as possible, he said.

Contrasting with this movement toward centralization of records were decisions by several companies to reestablish separate departmental meter records.

Meter Training Book Supported . . . Unanimous agreement of 66 companies greeted proposals to prepare training courses for metermen, advised F. A. Redding, Southern California Edison Co. Preference was for a series of pamphlets. But disclosure by G. A. Palmer, New England Power Service Corp, that a suitable book is in preparation by several meter engineers in his company swung the committee over to support the forthcoming volume.

LeClair. assistant to the vice president of Commonwealth Edison Co, explained to the conference.

Water supply, proximity to load, and problems of waste disposal were cited as major factors by LeClair. The extremely small weight of fuel supply needed for a nuclear plant makes proximity to fuel supply relatively unimportant, he added.

LeClair said that a nuclear power plant using present day technology would probably use a somewhat higher amount of cooling water per kilowatthour of electricity generated.

He noted that as the cost of nuclear power plants comes down, nuclear power units will be built one at a time on power systems of the country and assume their share of the additional power requirements for America's growing industry.

Washoe Project Report Is Approved by McKay

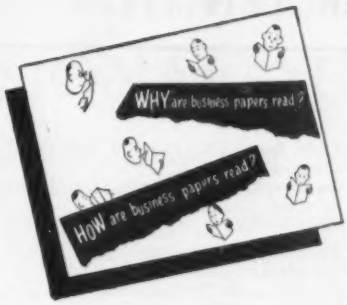
Two days of hearings were held in Reno, Nev., last week on the $41-million Washoe multipurpose project by Senate Interior subcommittee headed by Sen George Malone (R-Nev.). The hearings followed approval of a Reclamation Bureau report on the project by Interior Secretary Douglas McKay.

The report has been sent to the two states concerned—California and Nevada—along with affected federal agencies. There is some disagreement between the two states over proposed diversion of water from California to Nevada.

The project, on the eastern slope of the Sierra Nevada, would provide irrigation, power, flood control, public health, and recreation benefits.

Main features of the project would be (1) Stampede dam and reservoir on the Little Truckee River west from Reno and just over the line in California, Stampede tunnel and Calvada power plant with 20,000-kw capacity; and (2) Watasheau dam and reservoir on the east fork of the Carson River with an 8,000-kw power plant.

Of the total cost, $17,391,000 is allocated to irrigation and drainage, $18,247,000 to power, $5,820,000 to flood control, and $100,000 to recreation. Following developmental period, irrigation and drainage beneficiaries would repay an estimated $8,180,000, and the remaining portion would be repaid by power revenue.



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ELECTRICAL ENGINEER — Junior or Assistant Distribution Engineer — technical graduate with at least 3 years field experience operating utility Company. Permanent position with long established consulting organization New York. Some travel Latin American necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience and personal particulars. P-4390, Electrical World.

ELECTRICAL ENGINEER—Technical graduate—at least 5 years experience on electrical maintenance and operating problems of generating stations and substations of public utility companies. Permanent position with long established consulting organization New York. Some travel Latin America. Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience and personal particulars. P-4391, Electrical World.

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REPAIR SHOP foreman. 35 years experience on all types of electric motors. Past fifteen years in complete charge of repair and rebuilding for nationally known shop. Familiar with buying, rebuilding and selling of used equipment. PW-4438, Electrical World.

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1100	General Motors	16-278A	1600	720	250	Clark	GD-4	375	360
750	General Motors	12-567	1080	720	200	General Motors	8-268A	350	900
700	Worthington	EE-8	1000	327	175	General Motors	12-71	275	1800
600	General Motors	12-567	860	600	150	Worthington	CC-4	225	450
500	General Motors	8-567	720	720	150	Buckeye	80	240	600
500	Alco	6-121x13T	750	600	148	Fairbanks Morse	32E14	220	300
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2	2000/2400	G.E.	450	250/300	2300/4600
2	2000	G.E.	514	600	6600/13200
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2	2000	G.E.	450	600	2300/4800
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	12200
1	1000	G.E.	900	260	4100/6900
3	1000	G.E.	720	600	2300/4600
2	750	G.E.	720	275	2300/4800
1	500	Whse.	1200	125/250	2500
1	500	Whse.	900	250	440
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1	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond. Condensing—265 lbs., 440-3-60 Built 1944
1	750	G.E.	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn Exciter.
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1	300	G.E.	

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2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/56.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

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KVA	Make	Type	Ph	Voltages
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1	2500	Whse.	OISC	3	26400/13200 x 480
3	2000	G.E.	HVDDJ	1	66000 x 13800
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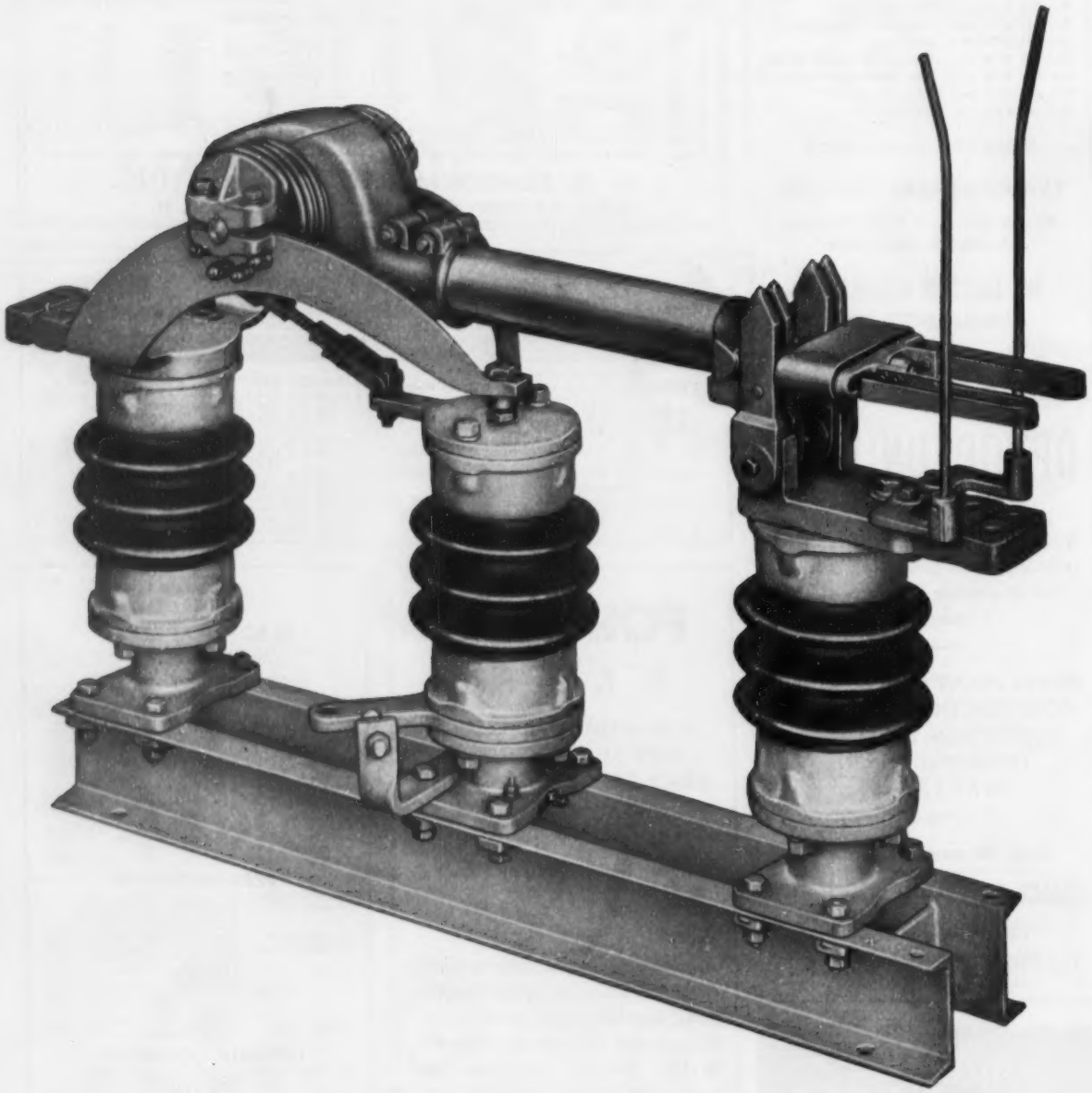

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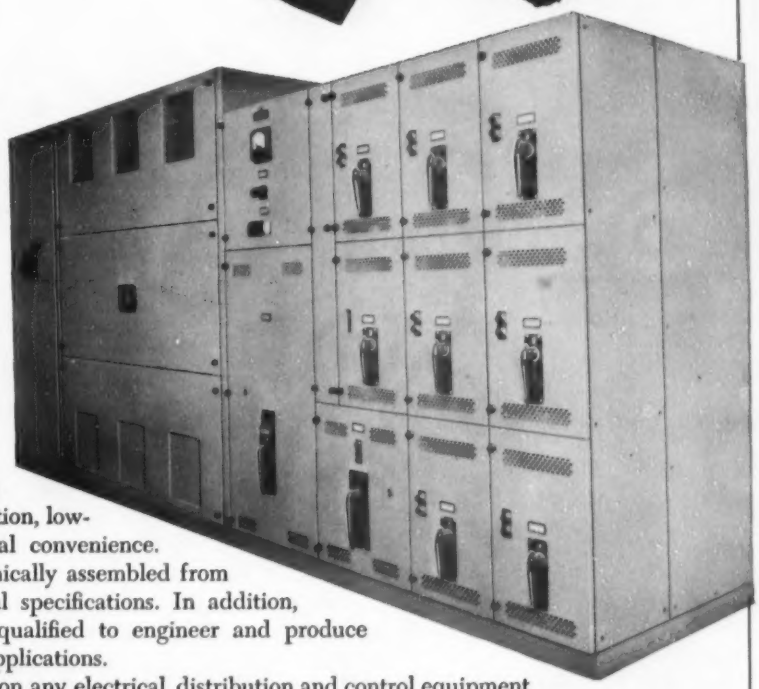

GRUMMAN AIRCRAFT ENGINEERING CORP., Bethpage, Long Island, N. Y., has recently occupied the Navy's new Peconic River plant designed for the assembly of the sweptwing, F9F-8 Cougar jet fighters. Modern to the last detail, the plant's distribution and control equipment for electric light and power is Federal Pacific throughout and includes 13 Unit Substations, 1500 feet of Plug-In Bus Duct, many Distribution Light and Power Panels, and a wide variety of miscellaneous devices.

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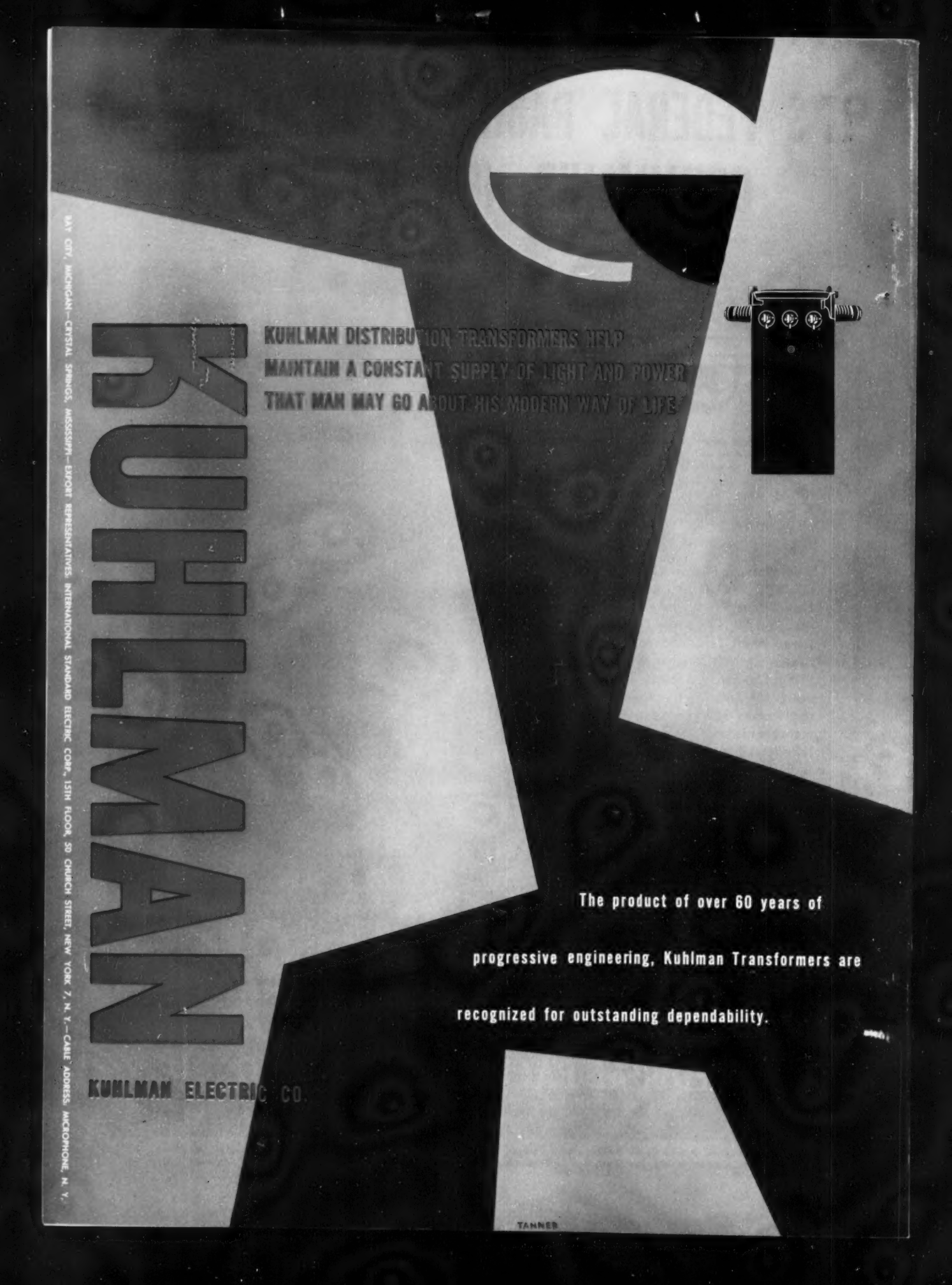
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